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Space Launch: 100 Successes, Zero Failures

Developing NCO Leaders
Enemies for Hire
Russia's Air Force



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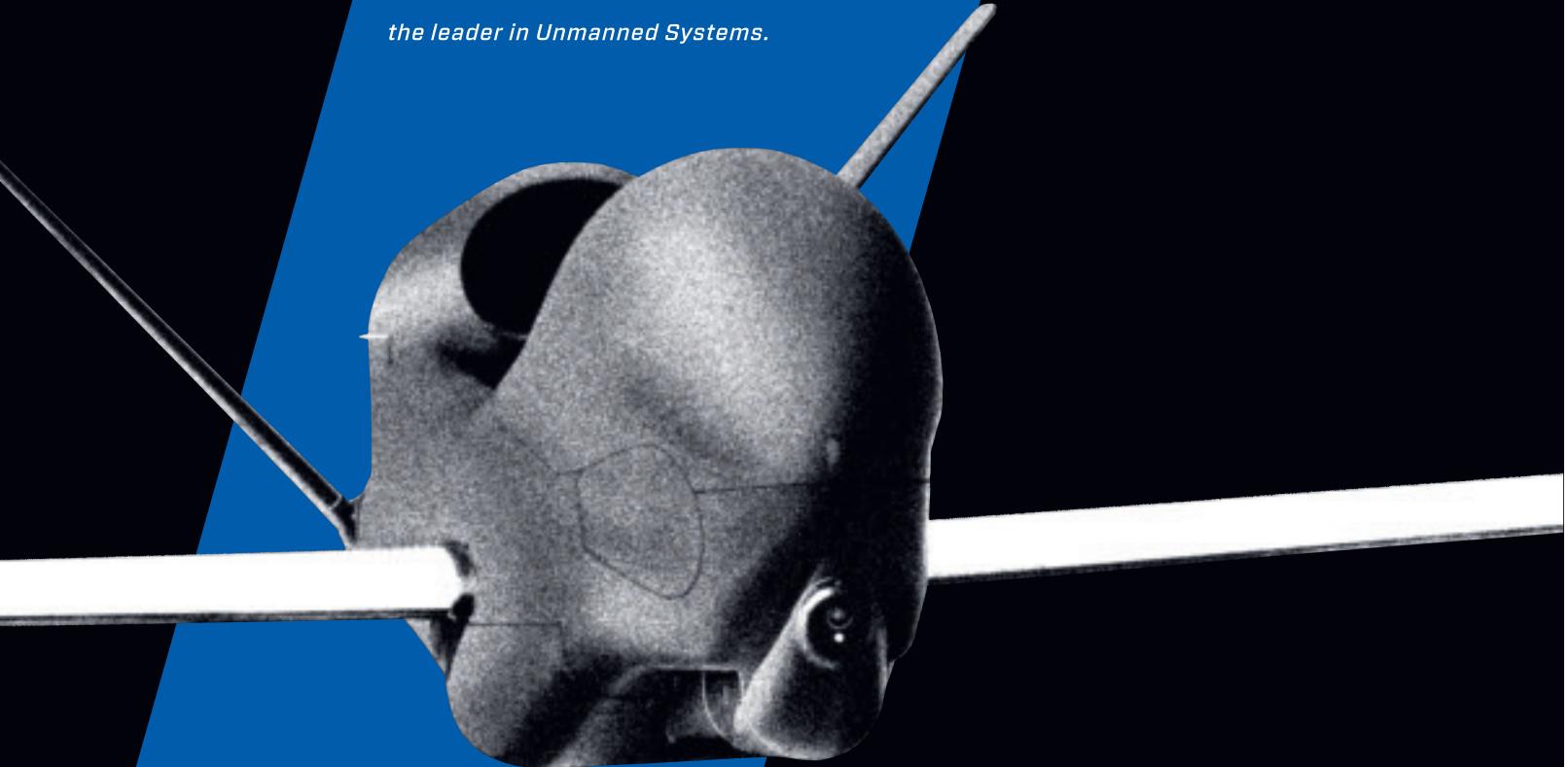
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About the cover: A United Launch Alliance Atlas V rocket hurls an NRO payload into orbit. See "Space Launch Renaissance," p. 20. Photo courtesy of ULA.



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Publisher: Craig R. McKinley
Editor in Chief: Adam J. Hebert

Managing Editor: Juliette Kelsey Chagnon
Special Content Director: Michael C. Sirak
Editorial Director: John A. Tirpak
News Editor: Amy McCullough
Senior Editor: Marc V. Schanz
Senior Designer: Heather Lewis
Special Projects Manager: Gideon Grudo
Designer: Kristina Parrill
Assistant Managing Editor: Frances McKenney
Associate Editors: Autumn A. Arnett, Aaron M. U. Church, June L. Kim
Production Manager: Eric Chang Lee
Photo Editor: Zaur Eylanbekov
Media Research Editor: Chequita Wood

Contributors: Walter J. Boyne, John T. Correll, Robert S. Dudney, Peter Grier, Richard Halloran, Daniel L. Haulman, Frederick A. Johnsen

Advertising: Andraea Davis, Mohanna Sales Representative
214/291-3660
airforcemagsales@afa.org

1501 Lee Highway
Arlington, Va. 22209-1198
Tel: 703/247-5800
Telefax: 703/247-5855
afmag@afa.org

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All Parochialism Is Local

DATELINE: MAY 22, 2014

THE Arizona Daily Stars' May 4 article got right to the point: "Planned Cuts Could Threaten Davis-Monthan's Future," stated the headline. Then, "The Air Force's plan to retire its entire fleet of A-10C 'Warthogs' could make Davis-Monthan [AFB] vulnerable to the next round of base closures."

Reporter David Wichner noted "changes would affect other maintenance and support squadrons, likely eliminating some 2,000 jobs."

This is all true.

If the A-10 fleet is retired, if Davis-Monthan is not assigned a significant new mission, if a new BRAC round is approved, and if D-M is selected for closure, then thousands of Arizona jobs would eventually go away.

That is enough to turn Arizona's lawmakers into fierce A-10 defenders, and Arizona is not unique in this regard. Warthog fever also gripped politicians in Georgia, Michigan, and Missouri—other states with A-10 operating locations.

The hysteria is not limited to the A-10. Other equipment cuts, pay and compensation proposals, and the BRAC proposal in particular all generated intense opposition from lawmakers who are placing their local political interests ahead of the nation's well-being.

In early May, the House Armed Services Committee rejected most of the Air Force's cost-saving suggestions. If the HASC's priorities stand, there will be no BRAC, because lawmakers are terrified of losing local bases. The HASC rejected benefit cuts because—despite rock-solid recruiting and retention numbers—"supporting the troops" through pay and benefits sells well on Capitol Hill. There would be no U-2 retirements.

Instead of putting the nation's needs first, many lawmakers are treating defense as a tool for re-election and as a communist-style jobs program.

This is not at all unusual, but the myopic parochialism is especially damaging now. Thanks to declining defense budgets, the urgent need to realign the nation's military forces, and the restrictions sequestration places upon defense planners, every bit of flexibility is important.

USAF planners are compelled to offer large, unpopular budget cuts because of Congress' own actions. Sequestration caps military spending and protects huge swaths of the defense budget from reductions. The Air Force is left with its readiness, modernization, and force structure accounts as the only places it can cut costs.

Whole fleets must be shut down to achieve big savings. The Air Force can free up \$4.2 billion over time by retiring the A-10, and the Joint

Political myopia is damaging the Air Force and the nation.

Chiefs pledged to reinvest savings into combat readiness and force modernization.

"Although military pay and benefits account for about 33 percent of the budget, our pay and compensation proposals account for only 10 percent of the planned cuts," the Joint Chiefs of Staff noted in their combined testimony to the Senate Armed Services Committee on May 6. "The remaining 90 percent of the cuts come from readiness, modernization, and force structure."

In May, House authorizers passed a bill to fund the A-10 in 2015, to the tune of \$635 million, by taking money from DOD's Overseas Contingency Operations account, which pays for ongoing combat operations. US combat operations in Afghanistan are to end this year.

The A-10's supporters adopt all manner of spurious arguments to justify keeping it in service.

■ "Soldiers love the A-10." Ground troops love the Warthog because they can see it in action during close air support runs, but this means the enemy can see the A-10 too—and target it. Other aircraft that perform CAS, such as the F-15E, F-16, and B-1 do it at higher speed or higher altitude, where the aircraft are less vulnerable to ground fire. In fact, the F-16, not the A-10, has been the primary CAS platform in Afghanistan.

■ "The A-10 is more cost-effective than other CAS platforms." This argument fails at both ends. If low operating costs are the goal, the MQ-9 Reaper is also used to destroy ground targets in benign airspace, and is much cheaper to fly than the A-10. Or, if efficiency is desired, the metric should be cost per target destroyed. In that calculation, the B-1 bomber's huge weapons payload moves it to the top of the effectiveness equation.

■ "There's no other fixed-wing aircraft that can do the job the A-10 can do." This is true in a narrow sense, not in terms of overall mission effectiveness. If the parameters are drawn narrowly enough, you can still rationalize Iowa-class battleships, SR-71 reconnaissance aircraft ... and the horse cavalry. When there's no money, however, the military needs maximum bang for its buck.

This is not an attack on the A-10, which performs an important mission very well. It must also be noted that the Air Force has little desire to retire the A-10. Chief of Staff Gen. Mark A. Welsh III, himself a former Hawg driver, recently said of the proposal: "Nobody likes it. Not me, nobody."

It is not too late to fix this budgetary snafu. Congress can end sequestration and provide the military the money it needs to reposition itself to meet future security needs. Or, the Air Force could be freed from micromanagement and allowed to actually organize, train, and equip its airmen.

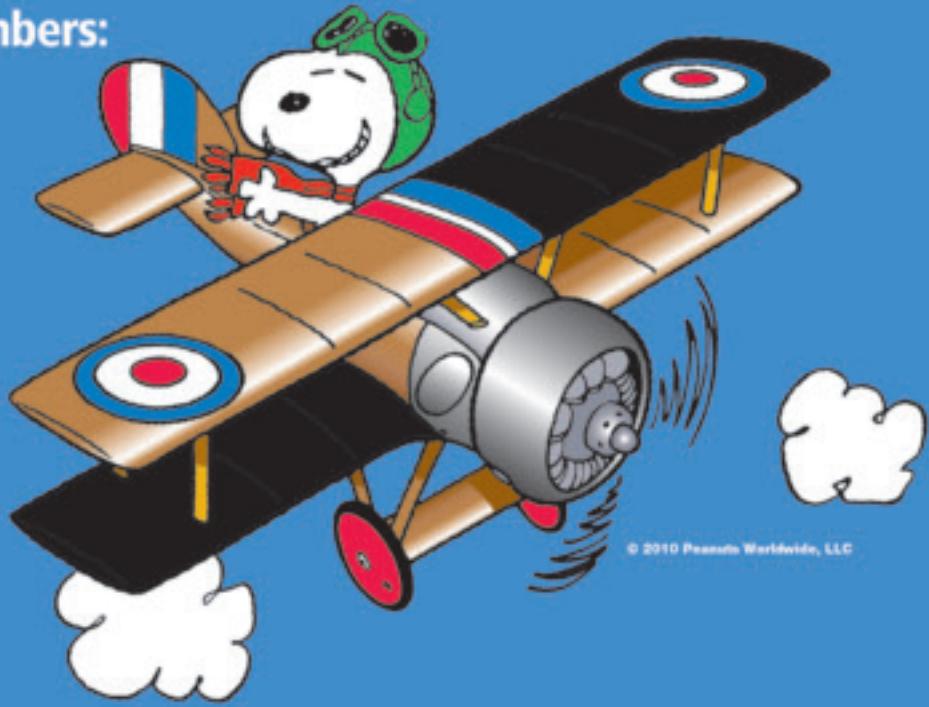
Of the four Congressional defense committees, by press time only the HASC had spoken. The other three committees can still act to support the Air Force's cost-saving proposals. They are painful, but there are only bad options available.

So far, Congress has refused to take action to end sequestration, but has eagerly tied the Air Force's hands by ordering it to keep specific portions of the force in service. And of course, no additional money is coming to pay for these mandates, so USAF is forced to cut spending on training and future systems to make ends meet.

The end result will be a force that is less ready to go to war today, and less ready to take on the challenges of the future. ■

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Sanctions, Schmanctions

I agree with the reasoning expressed in your April editorial [*“Crimea and Punishment,”* p. 4] but I believe you were remiss in not including the tools [Vladimir] Putin has to counter the West’s sanctions. Putin’s leverage is substantial and to have ignored that in your editorial was unfortunate. Russia is the largest energy exporter to the European Union (EU) as 38.7 percent of the natural gas and 32.6 percent of the oil consumed by the EU comes from Russia. In addition, Ukraine receives most of its natural gas from Russia. The United States has neglected the capability for refining and transportation of liquified natural gas for the last 50 years. As a consequence of this neglect, we are not prepared to supply the energy needs of the EU and Ukraine with that vital commodity.

The EU is Russia’s largest trading partner as 52.3 percent of all Russian trade is with the EU and 75 percent of foreign direct investment in Russia comes from the EU. Thus, sanctions would work for and against Russia. However, so far the EU, because of the trade and energy issues, has been reluctant to impose more stringent sanctions, and Putin is well aware of his leverage and the economic risks to Russia. In addition, Putin is aided by the fact that Crimea has been part of Ukraine only since 1954, when [Nikita] Khrushchev transferred the administrative responsibility from the Soviet Union to Ukraine. There is, therefore, not a long historical connection between Crimea and Ukraine, which weakens the case for intervention and stronger sanctions from the West.

Our Air Force flies from its base in Romania into Afghanistan. If we continue to have Russian overflight rights then those could be canceled. It would be possible to fly from Romania to Afghanistan and avoid Russian airspace, but that would require over flight of Georgia, Azerbaijan, and Turkmenistan. Putin could put pressure on each of those countries to deny such overflights. If he were successful in that effort it would make operations very difficult for the United States Air Force.

Putin’s popularity has soared with the Russian people since his seizure

of Crimea and the subsequent activities of his proteges in eastern Ukraine. Such popularity may very well allow a semi-dictator to withstand the difficulties imposed by any economic sanctions, including those more restrictive, than currently in force. This ability to withstand the pain of sanctions has certainly been true with Iran because of its nuclear program. The sanctions have not brought the Iranians, in a serious way, hat in hand, to the negotiating table and their truculence continues to this day.

Col. Lee R. Pitzer,
USAF (Ret)
O’Fallon, Ill.

The editorial, “Crimea and Punishment,” hit the nail on the head. The very last [sentence] is worth remembering: “The US is only helpless against Russia if it chooses to be.”

MSgt. Drayton Robinette,
USAF (Ret.)
Panama City Beach, Fla.

Remember the Depots?

The April article “Nuclear Readiness” was informative but incomplete because only operations were addressed [p. 40]. ICBM readiness requires both capable field operations and depot engineering. The best operations cannot mitigate the risks of engineering errors affecting safety or reliability. The engineering question is highly relevant since in 2013 all engineering responsibilities previously performed by the system contractor were moved in-house. Though a significant change, this new depot engineering approach was not addressed in the article. Is depot readiness important? Recall the last straw that caused the Secretary of Defense to lose confidence in Air Force nuclear operations in 2008 was an ICBM depot incident.

Brig. Gen. John Clay,
USAF (Ret.)
Ogden, Utah

There are no “systemic problems” in the Air Force ICBM personnel business. The end of the Cold War simply forgot them. The “Iron Fist” of the Strategic Air Command, with its global reach of bombers, tankers, and ICBMs,

theoretically held all threats at bay for many years.

I spent seven years of my career in the ICBM business as a crew member, instructor, flight commander, and squadron operations officer. At all times the importance of the top secret documents entrusted to us as officers and their handling was never in doubt. The importance of testing our continued knowledge to a 100 percent level was always enforced and encouraged from top to bottom in the chain of command. No one under my command ever cheated or was suspected of cheating—nor were any others within the ICBM community. It was the SAC way! We knew the mission and accomplished it!

In the missile business, it’s hard to motivate folks. Within SAC we had great motivational activities, such as missile combat crew competition, athletic competition, flight meetings between site managers, crews, and security teams, etc. I got my MBA through AFIT just for spending time underground. Is this still there?

In my opinion, placing the ICBM business under an admiral in a command with no apparent awareness of the codes involved or the importance thereof IS the problem. Perhaps there is a “systemic” problem here and a realignment may be the answer and keeping AETC out of it would help—as a rule they have no clue at this level.

Lt. Col. Jeff Valentine,
USAF (Ret.)
Friendswood, Texas

There must still be thousands of us alive who served in SAC, Strategic Air

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Command, with memory of how our bomber force was managed. A "barely passing grade" on the command, control, and execution procedures, was 100 percent—with no room for interpretation. All test questions were straight, answers obvious. Support of the bomber and missile legs of the triad was tested via management systems scoring such things as on-time takeoffs for airplanes and Vandenberg launches of missiles pulled from alert with their crews. All of SAC was readied for launch during the Cuban crisis with aircrews in airplanes as "live aboard" or in alert facilities on the flight line. Some bombers were dispersed to civilian airports, all practice alerts cancelled. All of the related activity was not lost on the Soviet intelligence community. To show any activity by a bomber force that could currently compare, would require a trip to the graveyard in Davis-Monthan.

Is it not apparent that one leg of the triad—subs, missiles, airplanes—is more than a little crippled? Whether testing of the remaining Air Force alert force in our missile silos should be viewed with alarm is a question of what they are tested on. Procedures that involve execution of the use of nuclear should be tested with 100 percent passing grade.

"If everyone were passing all the time there would be something to worry about" may mean everyone is sure they know how to deploy their missiles, not that the tests are not hard enough..

Lt. Col Bill Cross,
USAF (Ret.)
Davis, Calif.

Pandora's Box

Regarding Colonel Pitzer's "I Never Promised You a Rose Garden" letter [April, p. 6]: Although the disability reasoning needs rectifying (no one gets sleep apnea from serving), his first paragraph "and all so-called promises made or imagined by previous Administrations" opens the same Pandora's Box some DHS uninformed person opened when they stated, "Tricare wasn't designed for working age military retirees. They should buy into their work plan." Now it's all the buzz—if the government isn't held "to honor and totally fulfill" (his words) said promises, then what is to stop them from cutting back or taking away retirement?

Is it possible? They just tried to keep one percent from working age military retirees. It's not only possible, they did it! I'm glad I kept reading—thank you, Lieutenant Colonel Cook and Ron Miller, for your on-target and coherent comments. Shame on Colonel Pitzer for not thinking outside the box.

The government owes our retirement,

as in past tense. We earned it; they pay the bill (they set the requirements, not us!). Retirees are not some future expense—they are a past debt. For them to try and make retirees' pay into the military budget is boggling—I read less than one percent of our nation ever served, and 17 percent of those draw a retirement check. So those of us who paid with our dedication and bodies are not expected to pay again to carry this nation's defense? Preposterous. Let the 99 percent who do nothing for this country's defense other than pay taxes pay a bit more—or wear the uniform. After all, they want the protection. Stop punishing those who served 20-plus years.

SMSgt. Mark Cipriano,
USAF (Ret)
Elyria, Ohio

The letter by Col. Lee R. Pitzer in the April 2014 issue of *Air Force Magazine* regarding compensation and "promises" by the government clearly demonstrates how the colonel is out of touch with reality. I genuinely feel sorry for the colonel's spouse, I guess he is not bound by any "promise" he may have made at the wedding. If you really feel this way, sir, why don't you return your retired pay? After all, the current Administration should not be bound by the promises made 20 years ago when you joined.

With regard to service connected disabilities that he deems are unfair, simply applying for a rating does not guarantee a check, but in many cases it does guarantee services for injuries incurred while in the service of this nation and this is processed by VA personnel who authorize the compensation based on evidence.

Even more outrageous though is the claim that Air Force and Navy personnel are not subject to the hazards of "road patrols" or "IEDs." You may want to rethink that statement. My son-in-law (USAF) deployed in 2008-09 and 2012-13 doing "road patrols." I deployed in 2004-2005 (USN) and was subjected to "road patrols" and "IEDs" almost every day. US Navy Seabees, SEALs, and other sailors have augmented Army, Marine Corps, and other services since Day 1, and to imply that they do not deserve compensation is outrageous!

Thomas Izbrand,
Temple, Texas

Heart of the North

I read the article "The Heart of the North," by retired Col. Jack Broughton with amazement [April, p. 70]. He forgot to mention another critical element that saved the rear ends of many a fighter pilot: the men at the GCI (ground control intercept) sites in Thailand. I do not

know enough about the GCI sites in Vietnam to speak knowledgeably but I am positive they also worked their tails off. Let's not forget the controllers and aircrews in the AEW C-121s that spent hours flying at 50 feet over the Gulf of Tonkin.

It is true the fighters went north in flight formation, but they often came back with battle damage and required the assistance of both GCI and tanker crews to get home. GCI personnel took great pride in the assistance provided. I personally worked with one battle damaged Thud that with our (Brigham) help was hooked up over the west side of the Plain of Jars. For every four gallons of fuel pumped in, three gallons were lost. The tanker crew "pulled" (my words) the pilot over Takhli where a safe landing was made. Every tanker crewman that I have ever talked to was also justly proud of his efforts.

My experience was limited but many controllers can provide many more situations than this example. Just ask for comments.

Maj. Ralph Gibbons, Maj
USAF (Ret)
Fremont, Neb.

A very interesting article by Colonel Broughton and it brought back memories for this former boom operator about refueling the F-105. I believe every pilot tried to make the contact without my help but there was a little edge in front of the receptacle that would catch the boom nozzle. I would lift the boom up slightly just before the contact was made.

When the copilot said that the fuel flow had stopped, I would wait a few seconds before I triggered a disconnect to minimize the fuel that would get into the F-105 air-conditioning system.

CMSgt. Clarence E. Vold,
USAF (Ret.)
Yuba City, Calif.

Sorry, Wrong Number

John Correll's "Fear of Fallout" in the April issue [p. 64] of *Air Force Magazine* is a fascinating retrospective on a way of thinking [that] is hard to imagine today. However, the CONELRAD frequencies cited (630 and 1230) are incorrect. The musical mnemonic was "640 1240 CONELRAD."

Hank Caruso
California, Md.

■ Hank Caruso is right. My memory of the CONELRAD frequencies was wrong.—JOHN T. CORRELL

Old Time Autonomy

Full auto? Automation in warfare has been with us and improved over decades [*"The Autonomy Question,"*

Letters

April, p. 44]. Starting in the 1950s, USAF strived toward automating the air defenses of points of North America that would become known as "SAGE" (semi-automatic ground environment). Although the human element was still a part of this vast mixed network, these enormous vacuum-tube computers were later capable of self-directing F-106s and Bomarc missiles to their intended targets. Hence the digital-age and "push-button warfare" had come together.

Forthcoming evolution of smart machines may have made human pilots outdated, but the redundancy systems can still rely on the intervention of humans.

Vince Granato
Suisun City, Calif.

Blowhard Brass

Hardly a month passes before we are again chided by the Pentagon brass, both military and civilian, about making "tough choices" on the Air Force budget under the sequester, about cutting personnel costs, which are "spiraling out of control," and about "slowing the growth" of those same costs. At best, the rhetoric is shopworn; at worst, it is disingenuous to the point of being intentionally deceitful and dishonest [*Aperture: Three Levels of Budget Pain*, April, p. 12].

I entered the Active Air Force in 1969 from the Air Force Academy and served almost six years, including one year in SEA. Following Active Duty, I served two-and-a-half years in the Air National Guard, and then I finished with 13 years in the Air Force Reserve, retiring in 1990. Nearly two-thirds of my commissioned service was in the reserve as a Category H, Individual Ready Reserve (IRR). Except for 10 to 15 paid duty days each year, I received only inactive duty training points toward reserve retirement. Most years I accumulated 90 to 100 of these nonpaid points. In those days, only 60 IDT points were credited toward retirement, so I effectively gave up both pay and retirement credits totaling 30 to 40 points each year. According to my calculations, including inflation, those points represent about \$150,000 to \$200,000 in lost income over my expected retirement lifetime. Like all retired reservists I waited from my retirement (age 43) until age 60 to receive retirement pay and Tricare benefits.

I did all of this for two reasons. The first reason: I believed in serving my country. By any measure I believe that I did a fair job of it. I know many other military members whose service and sacrifice were much greater than mine.

The second reason that I served was that I believed that the Air Force had made a promise to repay me for some of this service with a pay and benefits package that would keep up with inflation and growing health care costs. Since I was self-employed for more than 30 years of my 37-year civilian career, I had no other employer-sponsored health care. Thus, at age 60 my wife and I started using Tricare, and then at 65, Medicare with Tricare For Life.

Now, those still serving, as well as those of us who are retired, are told that the Air Force can no longer afford to keep past promises. We are told that personnel costs are growing at a faster rate than the overall budget. Even though these assertions have been disproved by the facts many times, Pentagon civilian and military leaders operate under the guise of repeating these assertions so often that they will drown out the voices of reason who know the facts and who repeatedly refute such misinformation.

On a personal level, I am offended when I am told by high-ranking officers that they are "keeping the faith" with those of us who serve and who have served. I am even more offended by similar comments of high-ranking officers who are my alumni and who supposedly lived under the same honor code that I did. My response to those senior leaders is that I am willing to sacrifice for the good of the service only to the extent that the service cleans up its own act and shows us similar loyalty. This includes better management of the public funds that have been entrusted to our senior leaders for weapon system procurement. The recent history of Air Force leaders, in that regard, is woeful! Further, before the civilian leaders try to throw us "under the bus" on health care costs, perhaps they should examine their own track record of failure to implement the many cost-saving measures that have been repeatedly presented to them by members of the military coalition. Lastly, both military and civilian leaders need to ensure that all components of the Total Force, and military retirees, are not being singled out for a disproportionate share of the budget cuts by this or any subsequent administration. If, and only if, Pentagon senior leaders take such measures will I be a willing partner in any effort to make reasonable sacrifices for the good of the country.

From this process the lesson objective for all of us is to learn, and remember, that loyalty is a two-way street.

Lt. Col. Gary M. Bone,
USAFR (Ret.)
Castle Rock, Colo.



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Policy & Communications (news media) polcom@afa.org

CyberPatriot info@uscyberpatriot.org

Magazine

Advertising airforcemagsales@afa.org

AFA National Report natrep@afa.org

Editorial Offices afmag@afa.org

Letters to Editor Column letters@afa.org

Air Force Memorial Foundation afmf@afa.org

For individual staff members
first initial, last name, @afa.org
(example: jdoe@afa.org)

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Advocate for aerospace power and STEM education.

Support the Total Air Force family and promote aerospace education.

Computer code checking out in the KC-46; Keeping the tanker contract valid; More sequestration damage; The A-10's loyal fans

STOP ME BEFORE I SUCCEED AGAIN

The KC-46 tanker program is doing uncommonly well and figures to deliver on time and at the expected cost, according to the never-kind Government Accountability Office. But if Congress allows sequestration to resume in 2016—and there's no reason to think it won't—it will put a stop to such absurd success, potentially adding hundreds of billions to the tanker's cost and possibly throwing the whole project back open for renegotiation.

In an April report, "KC-46 Tanker Aircraft: Program Generally on Track, but Upcoming Schedule Remains Challenging," the GAO determined that the Pegasus tanker is actually underrunning its cost estimates by about \$300 million, for a cost of \$51.4 billion for 179 aircraft. The average program acquisition cost is now projected to be \$287 million per airplane, some \$1.8 million less per tanker than originally expected. The GAO warned that testing could slip due to delays in training air and ground crews, but noted that so far, "the program has not missed any major milestones" and that fabrication of the first four test aircraft is on schedule. The first is expected to roll out as soon as this month.

Even software, the typical bugaboo of new airplanes, "is progressing mostly according to plan," the GAO said of the 15.8 million lines of code to be used on the Pegasus tanker.

This is all good news, especially when schedule delays and overruns have become programmatic norms in defense contracting.

The Air Force put extra effort into making the KC-46 contract, as then-Chief of Staff retired Gen. Norton A. Schwartz said at the time, "bulletproof." It was structured as a fixed-price program. That means any overruns are entirely the financial responsibility of prime contractor Boeing. In its zeal to win the contract, Boeing actually underbid the tanker project by about \$200 million, explaining to shareholders that the larger production volume of similar cargo airplanes, parts, and potential foreign tanker sales will more than make up the loss-leader amount and turn a nice profit in the end.

Boeing illustration



The KC-46: On time, on budget, and in danger.

The catch for the Air Force is that to keep the program fixed-price, the service mustn't change the terms of the contract. Cutting airplanes from the buy, altering requirements, or any other fiddling with the agreement could be a deal-breaker. In that event, all aspects of the deal could be up for renegotiation, and Boeing—now the sole-source supplier and no longer just one competitor—would have far more leverage to recoup its lowballed millions, if not more.

Enter the sequester. If it resumes in 2016, the Pentagon says it will have to take five airplanes out of the KC-46 program, and that breaks the deal.

The House Armed Services Committee, in its version of the 2015 defense authorization bill, deleted one KC-46 from the Air Force budget, but a service spokesman said cutting the one plane will not break the contract.

"The ... KC-46 contract has flexibility built into production options; however, lot pricing and program costs are dependent on the quantity of aircraft purchased," he said.

HOW TO RAISE YOUR COSTS

Lt. Gen. Wendy M. Masiello, the Air Force's deputy assistant secretary for contracting—and nominated to be head of the Defense Contract Management Agency—told an industry audience in April that to live within sequester amounts, USAF would have to cut \$1.1 billion from the KC-46 program in the next five years. Such a move will expose the Air Force "to additional risk" in the cost and schedule, she said.

Speaking at an Air Force Association/Air Force-sponsored event in Arlington, Va., Masiello said the KC-46 "is moving exactly as we want it to" and warned that if sequester resumes, it's a "possibility" that USAF would have to eat Boeing's loss-leader development costs. Moreover, Boeing could conceivably negotiate higher prices for the remaining jets, especially if the deferments affect the company's worldwide supply chain of parts.

Last year, when the onset of sequester threatened the KC-46 contract, program executive officer Maj. Gen. John F. Thompson revealed that USAF scrambled to shave money from other programs to come up with enough funds to keep the deal unmolested. Masiello warned, however, that there probably won't be any slack in the budget to do that again, especially if the Air Force isn't allowed to retire the A-10 and U-2 fleets, disrupting the daisy chain of steps needed to reach sequester-mandated cuts.

INTERLOCKING PLANS

Chief of Staff Gen. Mark A. Welsh III, speaking at the National Press Club in April, said that USAF has carefully worked out a financial plan that will let the service buy all the new programs it needs—including not only the tanker but the F-35, a new bomber, and a replacement for the E-8 JSTARS—as long as Congress holds sequester at bay and accedes to USAF's airplane type divestitures. "It's in the plan, even at

[reduced] budgetary levels," Welsh said of the new projects, without "assuming money will fall from heaven."

"What we can't do," he said, "is maintain everything" such as the A-10s and U-2s and still buy the new gear the service believes it needs to be relevant in 2023 and beyond.

The KC-46 wouldn't be the only program thrown financially off track by the sequester. In mid-April, the Pentagon produced a list of \$66 billion worth of additional modernization cuts sequester would inflict. They included taking \$1.7 billion from the F-35 program, meaning the deferral of 15 Air Force jets. That, in turn, would hamper the program's continuing success in reducing the cost of the fighter, lot over lot, as lower quantities create less efficiency. The F-35 Joint Program Office issued a statement saying that F-35 unit costs would, indeed, climb as a result of sequester-imposed changes, to the tune of about \$1.2 million apiece. Over more than 2,000 planned jets, that adds up.

Other cuts the Pentagon reported it would take in order to hit its sequester budget marks include \$7.1 billion from shipbuilding, \$2.8 billion out of Army aviation, assorted other procurements trimmed by \$17.8 billion, munitions by \$5.1 billion, communications gear by \$3.4 billion, and assorted modifications by \$1.2 billion. A new adaptive engine technology project would also be sacrificed at \$1.3 billion. Science and technology accounts overall would be slashed by \$9.2 billion—a move that Pentagon acquisition, technology, and logistics chief Frank Kendall has labeled as "eating our seed corn," though he acknowledged it is unavoidable in context with the rest of the budget.

PLAN B FOR THE A-10

The Air Force agonized over a range of other choices before settling on early retirement of the A-10 fleet as the only logical big-ticket "vertical cut" to meet expected budgets for the next five years, including partial retirement of the Warthog fleet, Welsh said during his National Press Club speech.

If the Air Force kept only the A-10s that have already received new wings—42 have been installed, and 25 sets are ready for installation—it would save \$1 billion over the next five fiscal years, said Welsh. By contrast, taking all the A-10s out of service—and eliminating the logistics train that goes with them—saves \$4.2 billion, including about \$500 million in cost avoidance from re-winging the rest of the fleet. Welsh said there are "not that many places you can go" to get that level of savings, which are mandated by law.

To get comparable savings, Welsh said, "it would take about 363 F-16s [or] ... 14 squadrons" worth of retirements, or a drastic cut in the F-15E Strike Eagle fleet, or pushing buys of the F-35 "outside the Future Years Defense [Program] and buy them later, which drives costs."

The service also considered getting rid of its B-1B bomber fleet, but operational realities drove the choice to the A-10.

"We looked at all those options ... and we ran it through an operational analysis [using our planning tools] against the standard DOD scenarios," Welsh said. Every time, "we came very clearly to the conclusion that of all those horrible options, the least operationally impactful was to divest the A-10 fleet. That's how we got there."

Welsh insisted the choice was "not emotional, it's logical."

Another option, discounted out of hand, was "we could just ground a whole bunch of squadrons today and make it look like last year," when sequester forced USAF to ground dozens of units. The difference between saving \$1 billion and \$4.2 billion, he said, "pays for half our flying-hour program each year."

All the other airplanes in the tactical and strategic inventory can do close air support, Welsh said, proved over "thousands

and thousands of ... very successful sorties." The A-10, however, can only do CAS. Any other major cut would make it "impossible to achieve" victory in a "big conflict," he said.

Far more than with CAS, Welsh said, "we save big lives" by achieving air superiority and performing deep attack against follow-on forces.

SAVING BIG LIVES

Deep strike allows USAF to eliminate "the enemy's will to continue the fight by destroying their command and control networks, by eliminating their ability to logistically reinforce the fight in the front lines, by keeping their reserve forces from moving forward, ... [and] by eliminating their second-echelon and operational reserve so they never engage US or coalition troops on the ground," Welsh explained. By achieving air superiority, USAF gives all the services "freedom to maneuver and freedom from attack."

The F-15Es and F-16s can do air superiority and deep strike as well as CAS, and the B-1B can do heavy bombardment as well as precision CAS. In a budget-tight environment, USAF can only afford to keep multirole platforms, Welsh said.

"This is not about the A-10 not being a great airplane," said Welsh, who flew the A-10 for a chunk of his career and professes to "love" the airplane. "This is about where [we can] take operational risk." USAF must start moving toward the force it must be 10 years from now in order to cope with the threat as it is expected to be in 2023, he said. In that "high-threat environment," where speed and stealth will be crucial to survival, the A-10, which lacks those qualities, "will not be part of that solution," he said.

One of the early and vociferous leading opponents of the A-10 retirement was Sen. Kelly Ayotte (R-N.H.), who in early budget hearings was highly critical of the plan. Ayotte, whose husband is a former A-10 pilot, pledged in February to block its retirement. Ayotte even marshaled a press conference of lawmakers, former A-10 pilots, and joint terminal attack controllers who sang the A-10's praises.

In a Senate Armed Services Committee hearing about restructuring the Air National Guard and Air Force Reserve—with Welsh and Air Force Secretary Deborah Lee James giving testimony—Ayotte asked no questions about the A-10 issue. She commented broadly about the importance of good communications between the Active Duty and Air Force reserve.

Sen. John McCain (R-Ariz.) lambasted Welsh and James for suggesting the B-1 can do some of the CAS role. He called the A-10 the "finest close air support weapons system in the world" and demanded that the two offer alternatives that are "credible to those of us who have been engaged in this business for a long, long time." McCain said there is "incredible skepticism" about the A-10 retirement among Capitol Hill lawmakers, and when Welsh tried to elaborate on the B-1's role in CAS, said, "General, please don't insult my intelligence."

Although House Armed Services chair Howard P. "Buck" McKeon (R-Calif.) said he would allow the A-10s to be retired—provided they're stored in a condition such that they could be recalled to Active Duty—the final HASC version of the Fiscal 2015 authorization bill specifically prohibited USAF from retiring any A-10s. Twenty-five Democrats and 16 Republicans adopted an amendment introduced by Rep. Ron Barber (R-Ariz.) barring the A-10's retirement and ordering an independent report on what it would cost to use alternative platforms to do the CAS mission. Barber represents the district that includes Davis-Monthan AFB, where A-10s are based, as well as the Air Force's "Boneyard," where they would have been stored under McKeon's plan. ■

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Mobility Moves

Gen. Paul J. Selva assumed the leadership reins of US Transportation Command, while Gen. Darren W. McDew took charge of Air Mobility Command during ceremonies at Scott AFB, Ill., on May 5.

Selva succeeded Gen. William M. Fraser III, who had led TRANSCOM since October 2011, while McDew replaced Selva at AMC's helm. Selva had commanded AMC since November 2012. McDew received a fourth star prior to taking command of AMC. He had headed 18th Air Force—AMC's sole numbered air force—at Scott since August 2012.

Defense Secretary Chuck Hagel presided over the TRANSCOM command change, while Chief of Staff Gen. Mark A. Welsh III led the AMC change-of-command ceremony.

Hyten To Head Space Command

The Senate confirmed the nomination of Lt. Gen. John E. Hyten to receive a fourth star to lead Air Force Space Command at Peterson AFB, Colo. He will oversee the command's more than 40,000 airmen around the globe. Hyten succeeds Gen. William L. Shelton, who has commanded AFSPC since January 2011 and is slated to retire. President Barack Obama tapped Hyten for the post in March and the Senate gave its blessing on April 9. He had been AFSPC vice commander since May 2012.

Pegasus' First Perch

McConnell AFB, Kan., will be the first Active Duty-led KC-46A main operating base, while the Pegasus formal training unit will be at Altus AFB, Okla., officials announced.

"Making a final basing decision is an important step in recapitalizing the tanker fleet," said Air Force Secretary

Drone Drain

The Air Force does not have enough remotely piloted aircraft operators to safely and effectively bear the workload of current operations, and the service may find it difficult to retain them, according to the Government Accountability Office.

When the Air Force set manning levels for RPA units, it "did not account for all tasks these units complete," stated the executive summary of a new report on the RPA career field management, released April 10.

The service's own guidance notes that "low crew ratios diminish combat capability and cause flight safety to suffer," but USAF has done nothing yet to fix persistent undermining, states GAO.

"Further, high work demands on RPA pilots limit the time they have available for training and development and negatively affects their work-life balance," it added.

GAO issued a series of recommendations for USAF to "update optimum crew ratios; establish a minimum crew ratio; develop a recruiting and retention strategy; [and] evaluate alternative personnel populations to be pilots," among other updates.

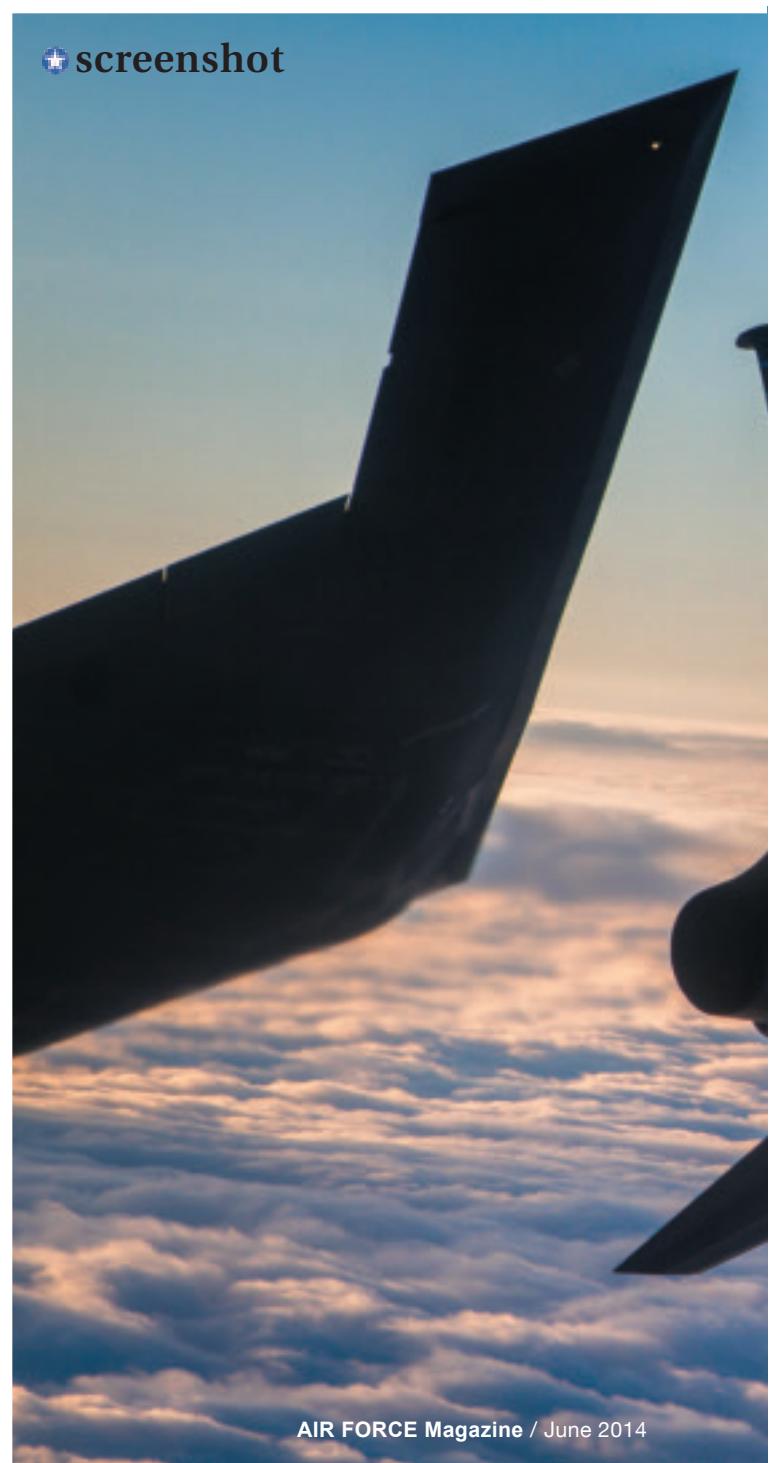
The Air Force concurred with several of the recommendations, and "partially concurred" with the remainder, states the report.

Deborah Lee James. "We will begin to replace our aging tanker fleet in 2016, but even when the program is complete in 2028, we will have replaced less than half of the current tanker fleet and will still be flying over 200 half-century-old KC-135 [Stratotankers]."

Both bases were selected as USAF's preferred alternatives in May 2013, pending the results of an environmental analysis, which was recently completed. At the time, USAF also announced it had selected Pease Intl. Tradeport ANGS,

Photo by Sagar Pathak

screenshot



N.H., as the preferred site for the first Air National Guard KC-46A main operating base.

An official decision on Pease is expected this summer, with the first ANG aircraft scheduled to arrive in Fiscal 2018, stated the April 23 release.

Australia Buys More Lightnings

Australia announced it will buy 58 additional F-35A Lightning IIs, boosting the Royal Australian Air Force's future fleet to 72 aircraft as part of an overall \$11.6 billion package, officials announced.

The Lightning II is slated to replace the RAAF's legacy F/A-18A/B fighters and the government "will also consider the option of acquiring an additional squadron of F-35 aircraft to replace the Super Hornets in the future," Australia's Defense Department stated April 23.

Lockheed Martin is scheduled to deliver Australia's first two F-35s to Luke AFB, Ariz., to begin RAAF pilot training

there this year. The F-35 development partner signed for 14 initial airframes in 2009.

Australia expects to welcome its first F-35 on home soil in 2018 and will stand up three operational F-35 squadrons and one training unit in 2020, according to officials.

AWACS Block 40/45 Breaches Nunn-McCurdy

The AWACS Block 40/45 upgrade program acquisition unit cost increased 22.5 percent above the program's baseline, making it one of four significant Nunn-McCurdy breaches in the Pentagon's newest selected acquisition report.

The program was considered a "significant breach" because the unit cost increased at least 15 percent, primarily due to a reduction in the overall number of units purchased from 31 to 24 aircraft, stated the report, published April 17.

"There were also unit cost increases associated with a stretch-out of the procurement buy profile caused by con-

05.01.2014

A B-2 Spirit bomber and a T-38 Talon execute maneuvers during a training sortie over Whiteman AFB, Mo.



gressional reductions, which resulted in the loss of synergies and required an additional year of interim contractor support, stated the report.

Though not a Nunn-McCurdy breach, the SAR also notes that the Air Force's Joint Direct Attack Munition program increased by \$788 million "due primarily to a quantity increase of 30,758 tailkits ... and associated schedule and estimating allocations."

C-17 Line Closing Sooner

Boeing will end production of the C-17 Globemaster III and close its Long Beach, Calif., final assembly facility in September 2015, three months earlier than originally expected.

The schedule was adjusted based on "current market trends and the timing of expected orders," Boeing stated in a release.

The company delivered the US Air Force's 223rd and final C-17 in September 2013 when it ferried aircraft P-223 to JB Charleston, S.C.

New START's Ballistic Breakdown

The Obama Administration is committed to the New START nuclear arms reduction agreement with Russia despite tensions with Russia over its military activity in Ukraine.

"We will continue to implement the New START ... because it's in our national interest," said M. Elaine Bunn, deputy assistant secretary of defense for nuclear and missile defense policy. "This Administration, like its predecessors, has sought a stable, strategic nuclear relationship with Russia—especially during times of turbulence elsewhere in the relationship," she told lawmakers during a House Armed Services Committee's strategic forces panel April 8.

The Defense Department announced the planned force structure breakdown of the 700 deployed bombers, ICBMs, and SLBMs allowed under the treaty earlier that week.

In addition, Bunn detailed DOD's plan for the 100 nondeployed launch platforms. These will include retaining the 50 Minuteman III silos emptied under the plan in "warm" status, as well as retaining six nondeployed B-52Hs in reserve and 40 empty submarine launch tubes, according to a release.

Challenging EELV

SpaceX is suing the Air Force over the service's latest Evolved Expendable Launch Vehicle contract with United

Launch Alliance, announced SpaceX CEO Elon Musk on April 25.

The company is arguing the long-term contract, which guarantees the purchase of 36 rocket cores from ULA—a joint venture between Lockheed Martin and Boeing—blocks other companies from competing for national security launches.

"This exclusive deal unnecessarily costs US taxpayers billions of dollars and defers meaningful free competition for years to come," said Musk. "We are simply asking that SpaceX and any other qualified domestic launch providers be allowed to compete in the EELV program for any and all missions that they could launch."

Musk told lawmakers in March that SpaceX had completed the three launches required to boost Air Force payloads into orbit and was still awaiting final technical certification.

"We're not battling the whole Air Force," Musk said in a press conference. "We're on very good terms with the vast majority of the Air Force. Our concern really relates to a handful of people in procurement."

Seven launches—down from 14—between 2015 and 2017 will be open to competition from outside companies, according to the Air Staff's space acquisition head, Maj. Gen. Robert D. McMurry Jr.

Friendly Match on Canadian Ice

A pair of LC-130 Skibirds from the New York Air National Guard's 109th Airlift Wing in Scotia joined Royal Canadian Air Force aircraft to provide airlift and reconnaissance support during Operation Nunalivut in the Arctic.

"We see on the horizon the need for aircraft capabilities to meet Arctic taskings," said Lt. Col. Clifford Souza of the 109th Operations Group. "We're trying to get out ahead of it and demonstrate LC-130 capabilities.... We want to develop joint capabilities and interoperability with the Canadian Arctic Forces because they have a need to maintain an airlift reach throughout the high Arctic."

The ski-equipped LC-130s are working alongside RCAF CC-138 Twin Otters to provision forward deployed forces in the vicinity of Resolute Bay in Canada's far northern Nunavut territory, according to the RCAF. This included use of ice runways. The deployment marked the first time the unit's LC-130s participated in the exercise.

The unit based its operations from Thule AB, Greenland, April 11 to May 3.

What's Your Exit?: SrA. Sean Meehan (l) and SSgt. Kane Lawlor provide cover during a tactical air insertion with Army UH-60 Black Hawk helicopters in the Pine Barrens at JB McGuire-Dix-Lakehurst, N.J., in April. Meehan and Lawlor, tactical air control party specialists with the New Jersey Air National Guard, were participating in joint training with the New Jersey Army National Guard.



USANG photo by TSgt. Matt Hecht

NATO's Pivot-Pausing Posture

British, Danish, and Polish fighters began jointly patrolling NATO's Baltic airspace from bases in Estonia and Lithuania, taking over from Air Force F-15Cs in April. Polish MiG-29s augmented by Royal Air Force Typhoons took over Baltic air policing at Šiauliai AB, Lithuania, while Danish F-16s deployed on quick reaction alert to Ämari AB, Estonia. The multinational fighters will patrol the Baltics for four months in the face of Russian military actions in Ukraine.

Russian military aircraft illegally breached Ukrainian airspace "on several occasions" in a single week in mid-April, reported Reuters.

NATO also dispatched French Rafale fighters to Malfbork AB, Poland, and Canadian F-18s to Romania "as part of the NATO efforts to reassure Allies in Central and Eastern Europe," according to the Alliance statement.

Defense Secretary Chuck Hagel met with Estonian Defense Minister Sven Mikser and Czech Republic Minister of Defense Martin Stropnický at the Pentagon the same week to discuss ways to bolster NATO activities in the Baltics. NATO's Atlantic Council discussed this as well the following day, according to the Pentagon.

Palms and Power Projection

A pair of B-52s from Barksdale AFB, La., and a pair of B-2s from Whiteman AFB, Mo., flew nonstop from their respective home stations on long-range, power-projection training sorties to Hawaii, announced US Strategic Command.

The bombers conducted a variety of activities during the 20-hour-plus flights on April 2, including dropping inert ordnance on Hawaii's Pohakuloa military weapons range and making low-level approaches over JB Pearl Harbor-Hickam, before heading back home.

"These long-duration, coordinated training missions allow our strategic bomber aircrews to execute synchronized global strike missions," said Maj. Gen. Scott A. Vander Hamm, 8th Air Force commander, who oversees AFGSC's dual-capable bomber fleet.

They are "vital to assuring our nation's leaders and our allies that we have the right mix of aircraft and skill to strike at the time and place of our choosing," he said.

The flights took place during the summit of the Association of Southeast Asian Nations' defense ministers in Honolulu that Defense Secretary Chuck Hagel hosted.

Holloman Flies Again

The first three F-16s assigned to the newly minted 54th Fighter Group at Holloman AFB, N.M., arrived to stand up the new F-16 formal training unit there April 1, according to a release.

By October 2015, Holloman is slated to receive 55 F-16s, most of them transferring directly from Luke AFB, Ariz., according to the group's webpage. The two F-16 squadrons from Luke replace Holloman's former F-22s and free up needed space at Luke.

"The change in mission to the F-35A [training] at Luke requires new construction in some of the existing F-16 aircraft maintenance unit space," explained Lt. Col. Scott Frederick, commander of Holloman's 311th Fighter Squadron, in a news release.

The recently activated squadron falls under the 54th Fighter Group. Holloman officials also plan to stand up a second flying squadron once assets arrive. A total of 917 personnel are transferring from Luke, plus there will be 23 new positions created at Holloman.

Tyndall's Combat Raptors Hit IOC

The first combat coded F-22 Raptor squadron at Tyndall AFB, Fla., reached initial operational capability with the arrival of its final F-22 in April, officials announced.

"We have all of our aircraft bed down, but we are still receiving operations and maintenance personnel in addition to a good amount of equipment," said Lt. Col. Erick Gilbert, commander of Tyndall's newly activated 95th Fighter Squadron.

"This is another milestone in the long journey of the 95th FS and Team Tyndall towards realizing our ultimate goal of having a combat F-22 squadron, mission ready," he added.

Tyndall received the last of 24 Raptors transferred from Holloman AFB, N.M., on April 8. The unit was slated for a Combat Hammer weapon employment evaluation in May to "drop dozens of bombs amidst a robust training threat" in the workup to full combat capability.

First JASSM-ERs Delivered

The first production lot of the extended range variant of the Joint Air-to-Surface Standoff Missile was delivered to Dyess AFB, Texas, following nine years of testing, earlier this spring.

The stealthy cruise missile can reach targets more than two-and-a-half times farther than the JASSM, enabling forces to neutralize targets while minimizing risk. "The initial delivery of the extended range variant of JASSM gives the combatant commander the ability to reach far deeper into contested areas with lethal precision," said Maj. Gen. Scott W. Jansson, Air Force program executive officer for weapons, in an April 8 press release.

JASSM and JASSM-ER share 70 percent of the same hardware and 90 percent of software. Only the B-1B bomber is certified to carry the extended range variant, but officials are looking to clear the F-15E, F-16, and B-52 to carry JASSM-ER.

Smart BUFF Begins

Technicians completed the digital upgrades to the first B-52 bomber modernized under the Combat Network Communications Technology program at Oklahoma City Air Logistics Complex at Tinker AFB, Okla.

The new data links, systems, and software allow real-time intelligence and targeting data transmission "so that they can get the most current data" to adapt flight planning en route, said Air Force Global Strike Command overseer Alan Williams.

OCALC began work on the first B-52 last July under a \$76 million low-rate initial production contract with Boeing. AFGSC has funding in place to upgrade 30 B-52Hs, with eventual plans to install upgrades on the entire fleet, the news release noted.

Tinker's 10th Flight Test Squadron redelivered the first B-52 to Barksdale AFB, La., on April 21.

Global Hawk Goes Feet Wet

The Air Force completed the first test flight of maritime surveillance modes on the radar of the RQ-4B Global Hawk Block 40 remotely piloted aircraft, service officials announced.

"We're very pleased with the initial results of the test flight," said Lt. Col. Michael Harm, materiel leader for the Maritime Modes risk-reduction initiative. The half-day test flight took place on April 14 at the Navy's Point Mugu sea range off the southern California coast.

The Block 40 variant carries the sophisticated MP-RTIP ground-surveillance radar supplied by Northrop Grumman and Raytheon. The maritime modes will also enable the radar to track and generate high-resolution imagery of vessels' movement at sea.

"This capability will augment the MP-RTIP's existing ground surveillance and provide the warfighter with a complete ground, coastal, and open seas picture," said Frank Hertler,

Maritime Modes program manager. The tests help integrate Global Hawk into the Pentagon's AirSea Battle concept to integrate air and sea forces more closely to overcome anti-access and area-denial threats.

Air Force Tests Google Glass for Combat

Evaluators at Wright-Patterson AFB, Ohio, are beta-testing Google Glass for its possible applications in combat, reported *VentureBeat*.

The goal is to help the military transition from heavy reliance on battlefield laptops to using smartphones, tablets, and "wearables" more in combat and intelligence missions.

Potential Air Force uses for Google Glass include helping forward air controllers steer aircraft to their targets, search and rescue missions, and helping combat controllers communicate with aircraft and ground troops in a variety of operations.

So far, the 711th Human Performance Wing is impressed with the ability to quickly access information, but software developer and civilian contractor Andres Calvo said in the press report, the glasses are "not a silver bullet for many of the Air Force's needs."

Google Glass is a wearable computer that incorporates an optical head-mounted display. The computer itself is Android-powered, mounted to the side of a pair of glasses and operates on voice commands.

Westover Takes a Hit Under Sequester

The 439th Airlift Wing at Westover ARB, Mass., will lose

Zulu, Did Timmy Fall Down the Well?: SSgt. Jeffrey Daum leads Zulu, his military working dog, through an obstacle course on April 12, during a demonstration at Eglin AFB, Fla. Military working dogs are trained to detect explosives, narcotics, and even hidden enemies. Air Force working dogs are handled by highly trained security forces airmen. At right, a three-month-old Belgian Malinois waits at JB San Antonio-Lackland, Texas, for his turn at the big show.

US-Philippines Sign Pact

The US and the Philippines agreed to a wide-ranging update to the countries' security cooperation, on President Barack Obama's recent visit to Manila.

The Philippine-US Enhanced Defense Cooperation Agreement provides "new momentum for our partnership and opens up fresh avenues of bilateral cooperation," said Philippine Foreign Minister Albert F. del Rosario in a statement issued after the two nations signed the agreement on April 28 following two years of negotiations.

The 10-year agreement addresses US-Philippine defense issues, such as interoperability of forces; capacity building to facilitate Philippine defense force modernization; improving Philippine maritime security and domain awareness; and enhanced humanitarian assistance and disaster response posture.

At the invitation of the Philippine government, the United States gains access to "designated areas" in Philippine military-owned and -controlled facilities and will construct new facilities and undertake infrastructure upgrades, according to the Philippine foreign ministry.

However, the United States will "not establish a permanent military presence or base in the Philippines," officials stated. The two nations will also set up pre-positioned stocks of defense and disaster relief material.

US service members will now rotate through Philippine facilities, increase training activities, "build the Philippines' defense capabilities," and "work with other nations to promote regional stability, such as in the South China Sea," said Obama during a joint press conference with Philippine President Benigno S. Aquino III.

—Marc V. Schanz

USAF photo by Samuel King Jr.



USAF photo by Breanne Smith

The War on Terrorism

Operation Enduring Freedom

Casualties

By May 23, 2014, a total of 2,320 Americans had died in Operation Enduring Freedom. The total includes 2,317 troops and three Department of Defense civilians. Of these deaths, 1,818 were killed in action with the enemy while 502 died in noncombat incidents.

There have been 19,772 troops wounded in action during OEF.

Warthog's Afghan Swan Song?

A-10s from Whiteman AFB, Mo., deployed to Bagram AB, Afghanistan, this spring on what is likely the type's last mission over Afghanistan before offensive combat operations cease at the end of the year.

Air Force Reserve Command A-10s from Whiteman relieved Warthogs of the 75th Fighter Squadron from Moody AFB, Ga., on a six-month rotation starting in April.

"This one's longer than normal deployments for the Reserves. ... We're here, possibly, as the last rotation of A-10s," said Lt. Col. John Marks, 303rd Fighter Squadron assistant operations director, in a video news release April 23.

The deployment is the unit's fifth supporting Operation Enduring Freedom and its third rotation to Bagram, according to unit officials. "There is a lot of history in this squadron, from Iraq all the way to Afghanistan," added Maj. Mark Loranger, unit assistant training director.

AWACS Unit Logs 4,000th Combat Sortie

On April 5, airmen of the 968th Expeditionary Airborne Air Control Squadron flew the unit's 4,000th combat sortie since the squadron began supporting operations in Southwest Asia in 2007, officials revealed.

half its C-5B aircraft due to federal budget cuts and the continuing impacts of sequestration.

Eight Galaxys will transfer from Westover to JBSA-Lackland, Texas, beginning in 2015, officials announced April 28. In addition, the wing will lose some 300 personnel, including 59 full-time enlisted and 275 drilling Reservists, stated a news release. "We will take care of our people. We will place as many as possible in other positions within the wing, and programs will be available to assist those displaced by this change in force structure," said Brig. Gen. Steven D. Vautrain, 439th commander.

By the Numbers



7

The number of personnel and aircraft the 18th Wing at Kadena AB, Japan, would need to mount a cohesive offensive against a 350-foot Godzilla.

18th Wing spokesman MSgt. Jason Edwards told Smithsonian's *Air and Space Magazine* in a tongue-in-cheek feature published May 6.

The squadron was the only AWACS unit operating in US Central Command's area of responsibility at the time, according to the mid-April release. "This accomplishment is not only a testament to the aircrews and staff that have rotated through the AOR, but also a phenomenal feat for AWACS maintainers," said Lt. Col. Ed Goebel, 968th EAACS commander. "The significance of this is even greater because it occurred in conjunction with the Afghanistan elections" when monitoring demands on allied forces were at a high point, he said.

US Troops in Afghanistan Could Drop Below 5,000

The Obama Administration is considering maintaining a force of less than 5,000 US military members in Afghanistan, far less than the 8,000 to 12,000 requested by military leaders for postcombat operations.

Thanks to promisingly high voter turnout in a "surprisingly smooth election," US officials say they now believe Afghan forces may be in a stable enough position to justify the smaller force, reported Reuters. The US forces remaining in Afghanistan after 2014 would focus on counterterrorism and training operations. "The discussion is very much alive," one US official who asked not to be identified told the news organization. "They're looking for additional options under 10,000" troops, he added.

In the absence of a bilateral security agreement the terms of the drawdown are unclear. Talks are expected to resume once Afghanistan's new President is announced. Troop numbers peaked around 100,000 in 2011. Some 33,000 US troops operate in Afghanistan today.

Three-Time Air Force Cross Recipient Dies

Retired Col. James H. Kasler, the only three-time Air Force Cross recipient and a former prisoner of war, died in Florida April 24. He was 87, reported the *Daily Journal*.

Kasler enlisted in the Air Corps as a B-29 Superfortress tail gunner, flying combat missions over Japan during World War II.

After commissioning, Kasler flew 100 combat missions as an F-86 Sabre pilot during the Korean War and downed six enemy MiGs.

On June 29, 1966, Kasler earned his first Air Force Cross as an F-105 Thunderchief pilot leading a strike against a heavily defended target in Hanoi, North Vietnam. Just five weeks later, he was awarded a second AFC for braving heavy ground fire while attempting to locate a downed pilot. His aircraft was hit during the search and he ejected, beginning six and a half years of captivity in North Vietnam.

He was awarded his third AFC for resisting torture and keeping faith with his fellow POWs through unimaginable hardship.

Kasler ended his 31-year uniformed career in 1975 as vice commander of the 366th Tactical Fighter Wing at Mountain Home AFB, Idaho. In addition to his three AFCs, Kasler received two Silver Star Medals, nine Distinguished Flying Crosses, and two Bronze Star Medals.

"We will continue to fulfill our global mobility mission before, during, and after these changes." The reductions are a move toward compliance with the Budget Control Act's mandated \$487 billion in defense cuts over the next eight years, stated the release.

Fewer Tails at Youngstown

Air Force Reserve Command's 910th Airlift Wing inactivated its 773rd Airlift Squadron at Youngstown ARS, Ohio, on April 6, according to a wing press release. The squadron's inactivation is the result of force structure changes that reduced the wing's C-130H fleet to eight primary and one backup aircraft, according to a wing official.

AFRC activated the squadron in 1995, and the unit supported operations in Afghanistan and Iraq after 9/11, stated the release.

Thunderbirds Milestone

The Air Force's Thunderbirds flight demonstration team flew their 2,000th F-16 Fighting Falcon demo during an airshow at Columbus AFB, Miss., in early April.

"The F-16 is a remarkable and dependable aircraft. It starts with its design characteristics, but the platform has

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always had excellent parts supportability, contractor partnership, and engineering oversight," said Capt. Lucas Buckley, Thunderbirds maintenance officer. "But the main reason we're still flying the F-16 here is the work done by the exceptional airmen in this squadron, who put in sweat equity each and every day to keep their machines safe, reliable, and effective."

The Thunderbirds began flying the F-16A/B in August 1982 and has now flown a version of the Falcon for more than half the team's history. ■

Senior Staff Changes

RETIREMENT: Maj. Gen. James J. **Jones**.

NOMINATIONS: To be Lieutenant General: Marshall B. **Webb**.
To be Major General: Mark A. **Brown**, John P. **Horner**, Roger W. **Teague**. **To be Brigadier General:** Robert G. **Armsfield**, Eric T. **Fick**, Peter J. **Lambert**, Stephen C. **Williams**.

CHANGES: Maj. Gen. Howard B. **Baker Sr.**, from Cmdr., Ogden ALC, AFMC, Hill AFB, Utah, to Dir., Log. & Sustainment, AFMC, Wright-Patterson AFB, Ohio ... Brig. Gen. John D. **Bansemor**, from Dir., Intel., EUCOM, Stuttgart-Vaihingen, Germany, to Dep. Chief, Central Security Service, NSA, Fort Meade, Md. ... Maj. Gen. (sel.) Mark A. **Brown**, from Dir., Financial Mgmt., AFMC, Wright-Patterson AFB, Ohio, to Cmdr., 2nd AF, AETC, Keesler AFB, Miss. ... Brig. Gen. Carl A. **Buhler**, from Dir., Log., PACAF, JB Pearl Harbor-Hickam, Hawaii, to Cmdr., Ogden ALC, AFMC, Hill AFB, Utah ... Brig. Gen. Mitchel H. **Butikofer**, from Dir., Policies & Resources, Office of Info. Dominance and CIO, OSAF, Pentagon, to Dir., C⁴ Sys., TRANSCOM, Scott AFB, Ill. ... Maj. Gen. Dwyer L. **Dennis**, from PEO, Fighters & Bombers, AF Life Cycle Mgmt. Center, AFMC, Wright-Patterson AFB, Ohio, to Dir., Global Reach Prgms., Office of the Asst. SECAF, Acq., Pentagon ... Brig. Gen. John W. **Doucette**, from Dep. Cmdr. & C/S, Jt. Warfare Center, Supreme Allied Command for Transformation, NATO, Stavanger, Norway, to Inspector General, ACC, Joint Base Langley-Eustis, Va. ... Maj. Gen. Terrence A. **Feehan**, from Vice Cmdr., SMC, AFSPC, Los Angeles AFB, Calif., to Dir., Rqmts., AFSPC, Peterson AFB, Colo. ... Lt. Gen. James M. **Holmes**, from Vice Cmdr., AETC, JB San Antonio-Randolph, Texas, to DCS, Strat. Plans & Prgms., USAF, Pentagon ... Brig. Gen. Blaine **Holt**, from Dir., Log., EUCOM, Stuttgart-Vaihingen, Germany, to Dep. US Mil. Rep. to NATO Mil. Committee, NATO, Brussels ... Maj. Gen. (sel.) John P. **Horner**, from Cmdr., AF Recruiting Service, AETC, JB San Antonio-Randolph, Texas, to Dep. Dir., Defense Threat Reduction Agency, Fort Belvoir, Va. ... Brig. Gen. James C. **Johnson**, from Dir., Log., AFRICOM, Stuttgart, Germany, to Cmdr., AF Recruiting Service, AETC, JB San Antonio-Randolph, Texas ... Brig. Gen. Mark D. **Kelly**, from Cmdr., 354th Fighter Wg., PACAF, Eielson AFB, Alaska, to Cmdr. 455th AEW, ACC, Bagram Airfield, Afghanistan ... Maj. Gen. Gregory J. **Lengel**, from Commandant of Cadets, USAFA, Colorado Springs, Colo., to Dir., Spec. Ops., EUCOM, Stuttgart-Vaihingen, Germany ... Maj. Gen. Robert D. **McMurry Jr.**, from Dir., Space Prgms., Office of the Asst. SECAF, Acq., Pentagon, to Vice Cmdr., SMC, AFSPC, Los Angeles AFB, Calif. ... Brig. Gen. Ronald L. **Huntley**, from Dep. Dir., Plans & Policy, USCYBERCOM, Fort Meade, Md.,

to Dir., Strat. Plans, Prgms., & Analyses, AFSPC, Peterson AFB, Colo. ... Brig. Gen. Evan M. **Miller**, from Vice Supt., USAFA, Colorado Springs, Colo., to Dir., Log., PACAF, JB Pearl Harbor-Hickam, Hawaii ... Brig. Gen. Patrick C. **Malackowski**, from Cmdr., 455th AEW, ACC, Bagram Airfield, Afghanistan, to Mil. Dep., Total Force Continuum, DCS, Strat. Plans & Prgms., USAF, Pentagon ... Brig. Gen. Mark M. **McLeod**, from Dir., Log., Engineering, & Security Assistance, PACOM, Camp Smith, Hawaii, to Cmdr., Defense Log. Agency Energy, Defense Log. Agency, Fort Belvoir, Va. ... Brig. Gen. Paul D. **Nelson**, from Dep. to DCS, Intel., Intl. Security Assistance Force, US Forces-Afghanistan, CENTCOM, Kabul, to Dir., Intel., EUCOM, Stuttgart-Vaihingen, Germany ... Maj. Gen. Leonard A. **Patrick**, from Cmdr., 2nd AF, AETC, Keesler AFB, Miss., to Vice Cmdr., AETC, JB San Antonio-Randolph, Texas ... Brig. Gen. John M. **Pletcher**, from Dir., Budget Ops. & Personnel, Office of the Assistant SECAF (Financial Mgmt. & Comptroller), OSAF, Pentagon, to Dir., Financial Mgmt., AFMC, Wright-Patterson AFB, Ohio ... Brig. Gen. John T. **Rauch Jr.**, from Chief, Concepts, Strategy, & Wargaming, DCS, Ops., Plans, & Rqmts., USAF, Pentagon, to Dir., Intel., Surveillance, & Recon Strategy, Plans, Doctrine, & Force Development, DCS, Intel., Surveillance, & Recon, USAF, Pentagon ... Brig. Gen. Duke Z. **Richardson**, from Dir., Log. & Sustainment, AFMC, Wright-Patterson AFB, Ohio, to AF PEO, Tankers, Air Force Life Cycle Mgmt. Center, AFMC, Wright-Patterson AFB, Ohio ... Brig. Gen. James C. **Slife**, from Dep. Dir., Spec. Plans Working Group, CENTCOM, MacDill AFB, Fla., to Vice Dir., Strategy, Plans, & Policy, CENTCOM, MacDill AFB, Fla. ... Maj. Gen. (sel.) Roger W. **Teague**, from Dir., Strat. Plans, Prgms., & Analyses, AFSPC, Peterson AFB, Colo., to Dir., Space Prgms., Office of Asst. SECAF, Acq., Pentagon ... Brig. Gen. Giovanni K. **Tuck**, from Cmdr., Defense Log. Agency Energy, Defense Log. Agency, Fort Belvoir, Va., to Dir. of Ops., DCS, Ops., Plans, & Rqmts., Pentagon ... Brig. Gen. James C. **Vechery**, from Dir., US Forces-Afghanistan Liaison to the US Embassy, Kabul, to Dir. Log., AFRICOM, Stuttgart, Germany ... Maj. Gen. Martin **Whelan**, from Dir., Rqmts., AFSPC, Peterson AFB, Colo., to Dir., Space Ops., Pentagon ... Brig. Gen. Sarah E. **Zabel**, Dir., C⁴ Sys., TRANSCOM, Scott AFB, Ill., to Dir., Cyberspace Ops., Office of the Chief Info. Dominance & CIO, OSAF, Pentagon.

SENIOR EXECUTIVE CHANGES: Richard W. **Lombardi**, to Principal Dep. Asst. Sec., Acq., Office of the Asst. SECAF, Acq., Pentagon ... David K. **Robertson**, to Exec. Dir., AF Test Center, AFMC, Edwards AFB, Calif. ... Jeffery R. **Shelton**, to Dep. Admin. Asst. to the SECAF, OSAF, Pentagon ... John A. **Weida**, to Dep. Dir., AF Staff, USAF, Pentagon. ■

By Robert S. Dudney

Still Digging

"Last year, our readiness levels reached an all-time low. As we struggle to recover, we don't have enough units ready to respond immediately to a major contingency, and we're not always able to provide fully mission-ready units to meet our combatant commanders' routine rotational requirements. ... [This year,] we'll take significant cuts to flying hours and weapons system sustainment accounts, reduce precision munitions buys, and lower funding for training ranges, digging our readiness hole even deeper."—**Gen. Mark A. Welsh III, USAF Chief of Staff, Senate Armed Services Committee, May 6.**

Still Bleeding

"We are continuing to hemorrhage readiness and cutting further into modernization."—**Army Gen. Martin E. Dempsey, Chairman of Joint Chiefs of Staff, Senate Armed Services Committee, May 6.**

Sending Signals

"We're telling them they just cost us too much, that they constitute a 'ticking time-bomb,' and that their sacrifice is 'eating us alive.' We are telling them that we are looking for a way out of fulfilling our commitments to them. This is not the right signal to send those who volunteered to serve in time of war."—**Sen. James Inhofe (R-Okla.), opening statement at Senate Armed Services Committee hearing, May 6.**

We Laugh. We Cry. We Barf.

"The rest of the world, almost unanimously, looks at America as the No. 1 warmonger—that we revert to armed conflict almost at the drop of a hat, and quite often it's not only desired by the leaders of our country but it's also supported by the people of America. ... We do it all the time—that's Washington, unfortunately—and we have for years."—**Former President James "Jimmy" Carter, interview with Salon, April 10.**

Victimhood Sucks

"There is one misperception of our veterans, and that is they are somehow damaged goods. I don't buy it. If we tell our veterans enough that this is what is wrong with them, they may actually start

believing it. While victimhood in America is exalted, I don't think our veterans should join those ranks. There is no room for military people, including our veterans, to see themselves as victims, even if so many of our countrymen are prone to relish that role."—**Retired Gen. James Mattis, USMC, remarks at the Marine's Memorial Club in San Francisco, quoted in USA Today, May 5.**

Rodman Clears the Air

"DENNIS RODMAN CLAIMS KIM JOHN UN DIDN'T ACTUALLY HAVE UNCLE EXECUTED AND FED TO DOGS."—**Actual headline from article in The Huffington Post, May 4.**

Advice to Freeloaders

"Today, America's GDP is smaller than the combined GDPs of our 27 NATO Allies, but America's defense spending is three times our Allies' combined defense spending. ... For decades, from the early days of the Cold War, American Defense Secretaries have called on European allies to ramp up their defense investment. And in recent years, one of the biggest obstacles to alliance investment has been a sense that the end of the Cold War ushered in the "end of history"—an end to insecurity, at least in Europe—and the end [of] aggression by nation-states. But Russia's action in Ukraine shatters that myth."—**Secretary of Defense Chuck Hagel, address to the Woodrow Wilson International Center, May 2.**

Army and the A-10

"The A-10 is a great close air support aircraft. ... However, ... in Afghanistan, there is a significant amount of [close air support] missions ... being flown by other platforms such as the F-15s and F-16s. The Air Force has come to us and said that they absolutely believe this will be able to meet our needs in close air support. So we are working with them in the future to develop those techniques and procedures that will be necessary to provide us the proper support of F-16s. ... We are supporting their effort."—**Gen. Raymond T. Odierno, Army Chief of Staff, Congressional testimony, April 3.**

Why Tops in Blue?

"The truth is, it hurts morale. We are cutting programs that airmen actually

utilize—bowling alleys, auto hobby shops, other activities on base—and yet we're continuing to make bases spend money on hosting Tops in Blue. There's not a company in the private sector that would—[in] such dire financial straits, and cutting thousands of personnel—yet keep a traveling show band on the payroll. It's maddening to a lot of people."—**USAF Capt. Gavin Light, former member of Tops in Blue, the Air Force's traveling performance troupe, Air Force Times, April 30.**

You Think That's Maddening?

"This annual Dog and Cat Fur Protection Report to Congress ... is required by legislative language set forth in the Dog and Cat Protection Act of 2000. ... During Fiscal Year (FY) 2012, there were no violations of the Dog and Cat Protection Act of 2000 ... discovered during stratified cargo examinations, indicating a high level of compliance with the Act."—**Actual text from a recent report, quoted in Washington Post, May 3.**

Careful What You Wish For

"America's allies are nervous. With Russia grabbing territory, China bullying its neighbors, and Syria murdering its people, many are asking: where is Globocop? Under what circumstances will America act to deter troublemakers? ... Some will celebrate the decline of America's ability to deter. But wherever they live, they may find that whatever replaces the old order is much worse. American power is not half as scary as its absence would be."—**House editorial in The Economist, May 3.**

Mocking a Mock Up

"Whatever Iran hopes to do with the mock-up, it is likely to have zero impact on US Navy operations in the Gulf. Firing weapons at a stationary structure floating on pontoons is not a realistic representation of having the capability to target a 100,000-ton warship ... maneuvering at speeds in excess of 30 knots."—**Cmdr. Jason Salata, US Navy 5th Fleet spokesman, on Iran's claim that it staged a successful attack on a "mock-up" of a US Navy aircraft carrier, Associated Press dispatch, May 6.**

Space Launch RENAISSANCE



By Marc V. Schanz, Senior Editor

Fifteen years ago, the space launch business was attempting to right itself in the wake of costly failures and setbacks. Times have changed.

In April, Air Force Space Command airmen launched a National Reconnaissance Office intelligence satellite from Cape Canaveral AFS, Fla. The event was treated as routine, but it quietly marked a significant milestone in USAF launch history. It was the Air Force's 100th consecutive successful national security space launch, a string that dates back to 1999.

The April 10 United Launch Alliance Atlas V launch, dubbed NROL-67, was the 81st for ULA since the Lockheed Martin and Boeing consortium was established in December 2006. It also was the second successful military space launch that month, as a Defense Meteorological Satellite Program satellite (DMSP-19) made orbit from Vandenberg AFB, Calif., a week earlier.

"I am proud of the persistence and focus of the launch team, the wing, NRO, ULA, and other mission partners to make this launch happen," said Brig. Gen. Nina M. Armagno, the 45th Space Wing commander, in a statement following the April 10 launch.

"Successfully launching two missions from two different coasts in just seven days is a testament to the team's one-launch-at-a-time focus and ULA's commitment to mission success and schedule reliability," said James V. Sponnick, ULA vice president of Atlas and Delta programs.

USAF senior leadership, on the other hand, allowed the occasion to pass largely unnoticed. Nearly two weeks after the launch, on April 23, Chief of Staff Gen. Mark A. Welsh

A United Launch Alliance Atlas V rocket stands ready to loft a National Reconnaissance Office satellite into orbit at Space Launch Complex-41 Cape Canaveral AFS, Fla.



III gave brief mention to the service's launch success in reply to a question about the status of developing new engines for the space heavy launch enterprise.

"We just hit 100 straight national security space launches," Welsh said at an event at the National Press Club in Washington, D.C., calling it "a spectacular success story."

The NSS launch count had been a mark of pride in the space community for years. USAF hit its 50th consecutive launch in March 2007, when another Atlas V sent six experimental satellites from multiple agencies into space.

Seven years later, space launching has picked up its pace. In 2013 alone, USAF successfully put the fifth and sixth Wideband Global SATCOM (WGS) birds, the third Advanced

Extremely High Frequency (AEHF) communications satellite, a fourth GPS IIF satellite, and the Space Based Infrared System (SBIRS) GEO-2 on orbit.

Undersecretary of the Air Force Eric Fanning told reporters March 5 that in Fiscal 2015 USAF plans 10 more launches and will pursue "potential new entrants" to the Evolved Expendable Launch Vehicle program. The 2015 and the future years spending plans solidify the Air Force's commitment to the launch program, Fanning noted, and the service has saved some \$1.2 billion from the program in 2015 alone.

Despite the price tag, USAF's leadership frequently points to military space launch as an unequivocal success. The US military is heavily dependent on the capabilities USAF puts



ULA photo

An Atlas V rocket at Vandenberg AFB, Calif., hurls a Defense Meteorological Satellite Program payload into orbit on April 3.

space launch, and instability in the space industrial base. The large block buy for the EELV, committing the government to purchasing 60 more vehicles and extending the program to 2030, was a way to regulate these costs long term and ensure stability in the launch enterprise.

The cost of a failure would, of course, be much higher both financially and in terms of mission impact, USAF leaders say.

“We have used competition, long-term contracts, ... and good understanding of costs to get better deals for the government,” Air Force Secretary Deborah Lee James and Welsh said of the EELV program in a statement to lawmakers April 2. “We must maintain our commitment to mission assurance that has resulted in unprecedented success,” they wrote.

At the time, there had been 98 national security space launches. DMSP-19 was slated to launch the next day, from Vandenberg, but James and Welsh

Success,

Despite the success of the USAF launch enterprise, its steadily rising costs have attracted criticism. From the start of the Evolved Expendable Launch Vehicle effort in 1995, Boeing and Lockheed Martin dominated the launch business as they retained most of the industrial and human capital base involved in it.

Even before the formation of the United Launch Alliance in 2006, critics charged the merger would remove incentives to cut costs. A December 2005 letter from the National Taxpayers Union to Congress claimed the companies had underestimated the costs of the EELV program and Congress had responded to requests for more funds by providing “assured access payments.” The arrangement ensures the companies “cannot lose money,” Paul Gessing, the NTU’s director of government affairs wrote. USAF approved the merger.

Since then, EELV has achieved 100 percent mission success, but costs have gone up. A March 2014 Government Accountability Office report said the program’s total acquisition cost grew some \$28 billion between 2012 and 2013, a 78 percent increase over its prior year numbers. During an

into orbit. During his March 5 meeting with reporters, Fanning said USAF has invested “well over \$100 billion in cutting-edge space capabilities” over the past 16 years, and these tools have been inextricably linked with US military and economic power, from GPS satellites to secure communications.

REINVIGORATED LAUNCH

The EELV program began in 1995 as a way to ensure US military access to space, increase reliability, and lower costs in the long run. Operationally, EELV has been an unqualified success and represents 81 percent of USAF’s launches during the 15-year run of national security space launches. The

program uses Delta IV and Atlas V booster rockets and it is a perfect 81-for-81 in national security space launches.

Meanwhile, the cost of operating EELV has crept up. Estimates for the program hover around \$70 billion in total, based on the need for 151 launches through 2030. According to a March report by the Government Accountability Office, this estimate is approximately \$35.7 billion more than the previous estimate USAF provided in March 2012.

Several causes are behind the rise in cost, the GAO noted, such as the extension of the program’s life span, the purchase of some 60 additional launch vehicles, the “inherently unstable nature” of military

added that they knew “the only launch that matters is the next one.”

THE BAD OLD DAYS

As bad as launch reliability had become at the end of the 1990s, it is almost shocking how quickly USAF turned things around. The string of successes began suddenly and ended a frustrating and expensive period marked by several extremely high profile space launch failures.

On April 30, 1999, a Titan IV rocket carrying a Milstar II satellite from Cape Canaveral successfully launched but left the satellite on a useless orbit and represented the third straight Titan IV failure. The Milstar II was, at the time, USAF’s most advanced communications satellite, and the event was the Cape’s single most expensive unmanned rocket launch failure in its 48 years of operations. The cost of the satellite and launch totaled \$1.23 billion.

That final loss came less than a month after an April 9, 1999, segment separation failure on another Titan. That mishap left a missile warning satellite on a useless orbit. The previ-

ous summer, on Aug. 12, 1998, a Titan IV rocket launching from the Cape exploded 40 seconds into flight. The launch vehicle and an \$800 million classified intelligence satellite were destroyed. A subsequent USAF investigation concluded the rocket’s electrical system was damaged before launch.

The failures were jarring for USAF’s space community. In May 1999, then-Air Force Secretary F. Whitten Peters asked for a sweeping review of the military space launch business, along with the NRO’s and USAF’s civilian contractors. Gen. William L. Shelton, AFSPC commander, in an April 2014 interview with *Air Force Magazine*, said the turnaround for USAF could be traced to a 1999 Broad Area Review of the launch enterprise. Former USAF Chief of Staff Gen. Larry D. Welch headed the study.

The BAR, Shelton said, showed the Air Force “had drifted away from tried and true mission assurance practices of the past.” In short, USAF, contractors, and the organizations involved in assembling both the satellites and integrating them into the launches were falling short of the tasks that examined all aspects, scenarios,

risks, and segments of a given space launch—performed over the course of the life cycle of a space vehicle development program all the way to its launch. This is known in AFSPC as mission assurance.

Since the BAR, leaders have stressed that the improvement of these processes is vital to the continued health of launches. Putting satellites in orbit is a very different business from fixing aircraft on a flight line.

“There are no unconstrained post-launch orbital corrections, and there are no de-orbits of spacecraft to fix faulty wiring,” wrote then-Brig. Gen. Ellen M. Pawlikowski in a 2008 white paper on mission assurance, when she was the deputy director of the National Reconnaissance Office. “There is no second chance for success. We must ensure that every launch places a satellite in the correct orbit and that once there, the satellite performs flawlessly.” Because of this, Pawlikowski said, the lessons of the Welch review should be continuously integrated into the EELV program.

Launch mission assurance, at its most basic, consists of three main parts: system design assurance, operational mission

At a Cost

April 2 Senate hearing, Sen. Lindsey Graham (R-S.C.) asked why USAF was reducing future competitive EELV launches in its five-year spending plan even though the Office of the Secretary of Defense has directed the service to open up more competition. It’s due to the longer life-span of some of those assets, Air Force Secretary Deborah Lee James replied.

GAO stated the vast majority of the 2013 cost increase came from buying 60 additional boosters, while \$6 billion in cost growth came from extending the program’s life cycle by a decade—pushing many launches to later years to save funds in the short run.

The March GAO report noted EELV had incurred a Nunn-McCurdy Act cost growth breach in 2012, prompting a program restructuring. This drove the Air Force to examine additional launch service providers—such as California-based SpaceX, which still awaits USAF certification for competition with its Falcon 9 launch vehicle. The long certification process and the scaling back of competition opportunities in the EELV effort have attracted the ire of SpaceX’s CEO Elon Musk.

During a March 5 Senate appearance, Musk said SpaceX has com-

pleted its three certification launches required to boost USAF payloads and was still awaiting final technical certification for heavy lift with its Falcon 9 rocket.

“The Air Force and other agencies are simply paying too high a price for a launch,” Musk said, claiming taxpayers could have saved \$11.6 billion on the last EELV block purchase had bidding opened up.

At the same hearing, however, ULA President Michael C. Gass touted ULA’s record of success and reliability. “I am ... pleased to report that ULA and the government team have consistently delivered 100 percent mission success,” he said, adding that ULA’s Atlas V and Delta IV are the “most powerful and most reliable rockets in the world.”

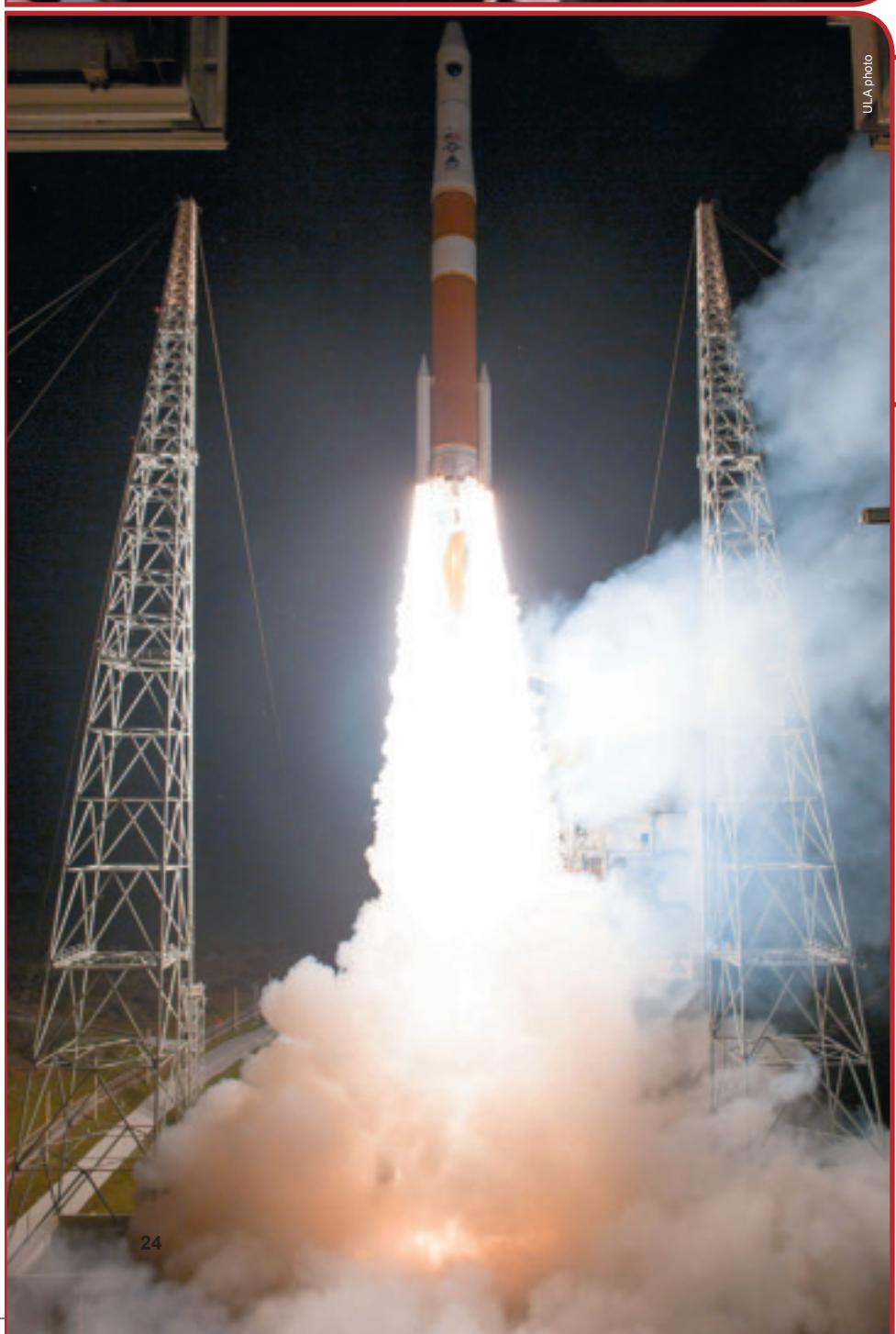
Musk and others claim there is a strategic vulnerability created by reliance on the RD-180 rocket engine for all Atlas V ULA launches. It is a Russian-made engine, Musk said in his testimony, and while the supply chain has spares, there is some risk in relying on a foreign supplier to guarantee space access, particularly one that the US is increasingly at odds with. Speaking to Senate appropriators in April, James said USAF has a two-year supply of

engines and USAF could always use Delta IV as a fallback.

The matter concerns USAF enough that a study of potential vulnerability in the supply chain for the engine was underway as of April, Air Force Space Command boss Gen. William L. Shelton told Congress on April 3. An indigenous engine program has advantages, Shelton said, two being the US would not be reliant on a foreign supplier and the US rocket engine industrial base would be shored up. “Both of those would make a great contribution to the overall launch program,” Shelton said.

There is some evidence that USAF leadership’s cost gambit on EELV may be working. In April, DOD released its annual Selected Acquisition Reports, detailing cost, schedule, and performance changes on major programs (the most recent running through 2013). The EELV program’s costs, the SAR stated, decreased \$3 billion, from \$70.6 billion to \$67.6 billion, due to “savings realized in the negotiation and award of the new 2013-2017 Phase 1 contract” and net decreases from a change in launch vehicle configuration requirements.

In late April, Musk announced that SpaceX is suing the Air Force over the EELV contract with ULA. 23



Clockwise: Gen. William Shelton, head of Air Force Space Command, speaks with Douglas Loverro, deputy assistant secretary of defense for space policy, in March. Shelton said the Air Force now looks at every launch as a first. Gen. Mark Welsh III, USAF Chief of Staff, speaks at the National Press Club in April. He called the streak a "spectacular success story." A Delta IV rocket lifts off at Vandenberg carrying a National Reconnaissance Office payload. A Delta IV lifts off carrying a GPS IIF satellite.



assurance, and independent space vehicle assurance. The first two show the launch vehicle and its payload have passed a review, with technical issues resolved and risks mitigated, and confidence in launch mission success is acceptable to the mission launch authority. This normally requires a review and validation of the launch system, assembly of the rocket, launch site, mission design, software, and command and control processes. A third and final step involves additional assessments by a third party to check assumptions of both contractors' and the Air Force's processes.

Mission assurance, as Shelton and others observed, is as much a culture as it is a collection of processes. Some of the lapses in mission assurance, leading to the failures of the late 1990s, were related to acquisition reform efforts, Shelton conceded in his April interview, but in other areas cost was a big driver in changes to tried-and-true practices.

As a result of the Welch BAR, the Air Force implemented launch process changes, such as increased independent reviews in the mission assurance process, improved systems engineering, and better USAF oversight of contractor mission assurance activities. "We have literally gone back to basics on the launch business, ensuring we maintain adequate mission assurance, and conducting hard-nosed reviews leading up to every launch," Shelton said.

EVERY LAUNCH IS A FIRST

The focus on mission assurance is one reason why AFSPC officials downplay the streak. Shelton said that today, every space launch is looked at as "our first in the sequence, not the latest in a long string of successes." USAF's record since 1999 "speaks to the efficacy of this approach," he said.

The NSS launch mission supports a wide spectrum of military and civilian agencies' activities on orbit, a reason it is often difficult to get an agreement between stakeholders on the mission count.

The national security space launch count includes AFSPC launches, Missile Defense Agency missions, US Navy satellite launches, and missions for other agencies with dual-purpose satellite launches, according to AFSPC officials. National Oceanic and Atmospheric Administration (NOAA) satellites are also included. NRO payloads count, as do missions supporting DOD agencies under what are called "national security missions."

The count does not include NASA missions, suborbital launches, commercial satellite launches, research and development, or civilian scientific missions. Following these criteria, and the public statements of senior USAF officials, the April 3 launch of the DMSP-19 mission at Vandenberg was the 99th launch, with the 100th following seven days later. The May 16

GPS IIF launch from Cape Canaveral became the 101st success.

But reliable launch is not the only factor in maintaining military space capabilities, particularly as near-peer rival nations build weapons that could disable or even destroy key US space assets. This potentially creates the need to rapidly replenish on-orbit capabilities. "An agile architecture that provides enhanced resiliency and redundancy is critical to maintaining our advantage in space," Fanning said in March.

Launch is critical to USAF's space capabilities. Shelton said he believes USAF builds "just enough, just in time to keep our constellations healthy." Unlike other USAF capabilities, AFSPC does not build excess capacity to compensate for attrition and does not plan for failure of the launch vehicle or the satellite itself. One of the reasons USAF is slashing the number of planned "competitive" space launches in its five-year plan is due to the longer lifespan of some of those assets, such as the GPS constellation and some AEHF satellites.

"We must become more resilient, not only to failure but also to attack," Shelton said. Several USAF studies underway will decide how to balance on-orbit needs with "affordability and resilience," he said, taking into account ideas such as disaggregating payloads, using different orbits, co-hosting payloads on commercial satellites, or joining with allied nations' satellites. All of these concepts are being considered for an "alternative architecture" for the future.

Service leadership continues to strike a cautious tone on the future. "One of the things we have to be very careful about in any decisions in the space launch arena is first do no harm," Welsh said in his April 23 speech in Washington. "And make sure that as we transition, we transition in a smart, meaningful, dedicated, ... detailed. And I think that clearly it's a good time to look at 'what is the future of heavy space launch and propulsion?'"

In a House Armed Services Committee hearing in March, James emphasized that USAF's launch success should not be traded against mission assurance. Critical national security payloads require stringent controls, and the service won't compromise on them.

In a nod to the lessons of 1990s, James said the Air Force seeks to lower costs in the long term but is not willing to take chances. "Some [launches] have almost catastrophic consequences" if they fail, she said. "There would be huge military significance."

MSGT. Kevin Thomas, the Air National Guard liaison to the Chief Master Sergeant of the Air Force, is in many ways the face of senior non-commissioned officer evolution.

A veteran aerospace ground equipment mechanic, he transitioned to the Air National Guard from Active Duty in the mid-1990s, serving in professional military education assignments, then as a logistics analyst at 1st Air Force before arriving at the Pentagon as the ANG's liaison to the CMSAF in August 2013. He is also the first Air Guardsman to serve in the new billet.

"The idea was to have a liaison in the office that [CMSAF James A. Cody] could reach out to on an immediate basis, that impacted the Air Guard and enlisted airmen," Thomas said of his day-to-day duties. Chief Cody felt "he needed to get representation from Active [Duty], Guard, and Reserve" to help guide deliberations on policies which would affect all corners of the enlisted Total Force. Thomas is now a subject matter expert for senior leaders and is in the middle of some wide-reaching policy changes.

ONE GOAL, ONE PRODUCT

As such, Thomas has spent a great deal of time in and out of meetings that are in many ways determining how the Total Force will look in the future. He will often liaise with the ANG Readiness Center for personnel discussions surrounding the "three-in-one" initiative—USAF's push to combine as many of the Active Duty, Air Force Reserve, and ANG instructions and regulations into one product. "There are impacts to the Guard in decisions every day," and knowing the impacts of decisions made at the Air Staff level is critical to good AFRC and ANG integration.

Thomas' two-year tour at the Pentagon is an example of how USAF wants to build its senior NCOs into more strategic assets to be utilized across the Total Force.

When Thomas finishes his tour, he will have valuable exposure to the "executive level" of the Air Force, he said, and will have knowledge of how policies are formed and implemented. Upon completion, Thomas anticipates he will return to an Air Guard- or National Guard-centric organization.

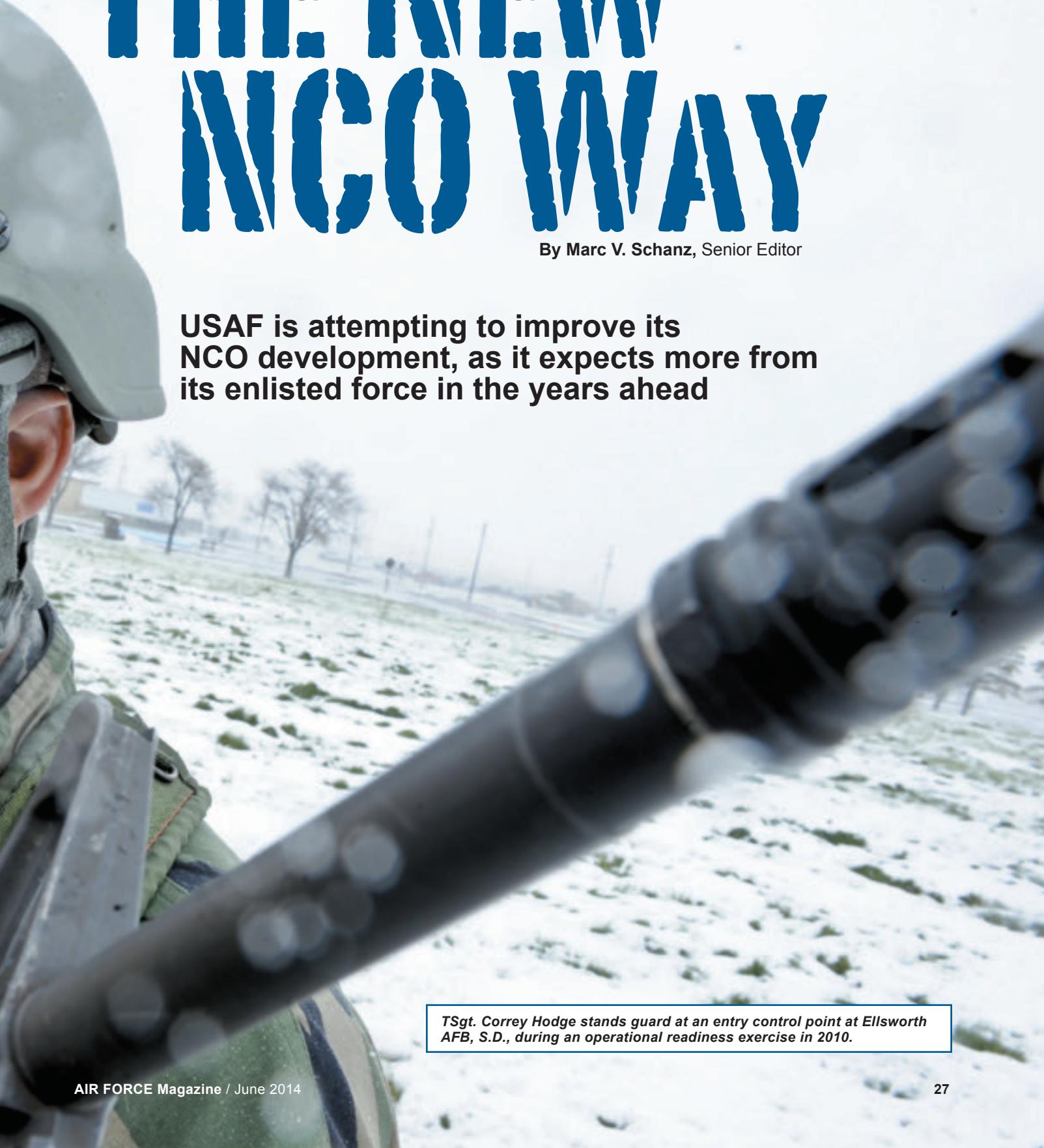
"When people are wondering 'what is going on at the Pentagon?' I'll be able to help," he said. "I'll be able to give insight, that this is part of the process, and I'll help build trust between [the Air Guard and USAF leadership]."

Thomas' position is just one of many into which the Air Force wants to put

USAF photo by SRA Adam Grant



THE NEW NCO WAY



By Marc V. Schanz, Senior Editor

USAF is attempting to improve its NCO development, as it expects more from its enlisted force in the years ahead

TSgt. Correy Hodge stands guard at an entry control point at Ellsworth AFB, S.D., during an operational readiness exercise in 2010.



USAF photo by A1C Gustavo Castillo



USAF photo by SrA. Christina Brownlow

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senior NCOs in the coming years. With its Fiscal 2015 budget being vetted on Capitol Hill, USAF leaders have made the case that another painful round of personnel reductions are needed: an estimated 25,000 cut from the end strength over the next five years to offset rising personnel costs and help pay for modernization and readiness needs.

“While we are going to be smaller, ... how we execute that is going to be hard,” CMSAF Cody said in a March interview. “It’s going to be hard on our airmen and our families. There is a lot of uncertainty right now.”

While USAF is cutting aircraft and equipment, it is also focused on reducing its personnel costs—as are the other services—while retaining the hard-earned experience and talent in an NCO cadre built from years of combat operations. With a large majority of the force in the enlisted ranks, Cody and senior USAF leaders say the service is looking to retain and possibly expand the roles and responsibilities of its most talented NCOs.

This means changes to NCO professional military education, changes to developmental special duty assignments, and—potentially—a rethinking of the appropriate roles for and responsibilities of NCOs serving in billets now held by

company grade officers, according to Cody and Chief of Staff of the Air Force Gen. Mark A. Welsh III.

The USAF force-shaping debate is spurring a broad and deep look at the functions, roles, and development of the noncommissioned officer. As USAF draws down, there is opportunity to get some of these processes ironed out.

“There’s a lot of goodness going on,” Cody emphasized. “We are still very much looking at how we are evolving and developing [the enlisted] force to make sure they have the capabilities and skill sets the nation demands.”

Today, approximately 82 percent of airmen are enlisted, and the service knows any changes to personnel compensation and benefits will have wide-ranging repercussions.

USAF also wants to establish master sergeant promotion boards, in an attempt to help identify high performers earlier in their enlisted careers (senior NCOs go before boards, but moving from tech sergeant to master sergeant does not require a board). Cody and Welsh have said repeatedly they want to see these promotion boards established. The sooner the Air Force can identify its “performers,” they say, the better for the long-term health of the service as it tries to tighten up and survive

the sequester while still retaining as much human capital as possible.

Cody said USAF is looking to execute master sergeant promotion boards “next year, as long as we have the capacity to do so. ... It’s not that we are not promoting the right people today, but the roles and responsibilities [of NCOs] today as opposed to 30 years ago have changed, and so that process should change,” Cody said.

SOUL SEARCHING

Cody’s office has inherited the drive to improve senior NCO development from his predecessor, former CMSAF James A. Roy, but the issue has only grown in importance as the service is now faced with some deep soul searching about what it expects out of all its airmen in the years ahead. “Do I worry about losing people in all this? Absolutely,” Cody said during a tour of USAF bases in the Pacific last summer with Welsh. “But we have the most capable people we have ever had today. And down to the youngest airmen, they all understand they are a part of what we are going through.” As the force shrinks in the coming years, the argument goes, every individual airman becomes even more important, not just in their particular job or field, but as a leader helping to mold and retain the force, and pass on that experience and perspective to younger airmen.

Cody, a career air traffic controller, said a good number of junior enlisted airmen he’s come across over the years don’t think of themselves as having leadership potential because of the way the enlisted force emphasizes technical skills. It’s the

[1] SrA. Justin Gordon, an assistant noncommissioned office in charge [NCOIC] of survival, evasion, resistance, and escape training, completes a static line jump at Spangdahlem AB, Germany. [2] MSgt. Michael Noel (c), the Secretary of the Air Force Public Affairs superintendent of force management, performs elevated push-ups with US Marines during a senior enlisted professional military education course. [3] TSgt. Tabatha Polson, NCOIC of an immunization clinic, checks through supplies at Davis-Monthan AFB, Ariz.

**2**

goal of USAF leadership to retain the knowledge airmen have built up in the first decade of their careers and pass it on to their fellow airmen.

“People get really good at their job, they like their job, and they’re happy to do that job,” Cody said at last September’s Air & Space Conference.

The Air Force builds the enlisted force this way because of the technical, skill-driven nature of the work of the enlisted force—from life support shops to flight lines to communications squadrons. For the first 10 to 12 years of an enlisted person’s career, an airman will work to master a particular skill set.

“You’re proud to be an airman, but you’re probably just as proud and sometimes more proud to do the job you do and think less about being an airman,” Cody said. USAF wants to take the airmen who might leave the service at the end of an enlistment and convince them that there are greater opportunities in the force.

Therefore, USAF is looking very closely at what it dubs “deliberate development,” or making sure junior NCOs identified as solid performers continue on with the service, and move into leadership roles, joint and international assignments, and eventually senior positions. To accomplish this, the service is retooling how it approaches key leadership billets in the enlisted force, particularly “developmental special duties”—a series of 10 special assignments to include military training instructors, recruiters, USAF Honor Guard, first sergeants, professional military education instructors, career assistance advisors, technical training instructors,

US Air Force Academy trainers, military training leaders, and airman and family readiness center NCOs.

These positions were filled largely on a volunteer basis prior to 2013, Cody noted in March. Now the billets are drawn from nominations at the major command level, from staff sergeants to master sergeants, and these positions are of great influence across the NCO corps. They have been identified as jobs that cultivate “strategic” airmen. From the point of recruitment, through tech training and Airman Leadership School, NCOs will get the chance to directly guide and influence the force before going back into their career fields with added experience. A nomination-based process ensures

these duties are filled and a ready pool of candidates can meet demands.

The growth of senior enlisted leaders in special assignments, fellowship programs, and joint billets has steadily increased as command chiefs and senior leaders see more value in building senior NCOs with broad exposure to many aspects of today’s Air Force.

SMSgt. Melanie Noel, who prior to her arrival in Washington, D.C., served a long career in security forces, personnel, and in basic military training, recently participated in USAF’s Congressional Fellow program in 2013.

“I tried to give perspective on the enlisted population of the Air Force,” she said. “It’s a point of view [staffers] didn’t get often.” Noel noted she served on the House Armed Services Committee during many of the debates surrounding the courts-martial emanating from abuses at JBSA-Lackland, Texas. As a former first sergeant at Lackland, with one stint in BMT and the other in tech school, Noel’s views were valuable to her member’s office.

An airman assigned to the billet does not give official USAF statements (those must come through the legislative liaison) but is in a position to give perspective about how certain aspects of the service work, in addition to learning about the legislative process.

Noel was also the first senior NCO in the Congressional Fellows program. The Air Force decided in 2011 that it wanted to open the opportunity to senior enlisted airmen, an initiative driven by then-CMSAF Roy and expanded under Cody. She cut the program short, however, when she learned she was selected for promotion to

**3**

USAF photo by SrA. Christine Griffiths



MSgt. Patrick Noppenberg, an NCOIC of food services at Kandahar AB, Afghanistan, organizes supplies for a kitchen that provides some 1,500 meals per day.

chief master sergeant, and now is moving into a position in the Air Force's Sexual Assault Prevention and Response Office on the Air Staff. Another senior NCO, this one with an intelligence background, will follow on in the position soon and more senior NCOs are expected to follow in years ahead.

"I think it was a huge opportunity and is something we need to spend more time and get more folks into," Noel said of her experience. "We've talked a lot about whether we need a highly educated enlisted force, but I think it's absolutely critical for a senior leader. You want someone who, when they sit at the table, at a [combatant command] or at NATO in a senior position, [is] able to speak and be in concert with their boss and represent your background. ... You can only do that if you have the experience and education to go along" with it, she said.

CONTINUING EDUCATION

In addition to ensuring senior NCOs get to fill special duty assignments, USAF is also retooling how it educates and builds the senior enlisted force. Welsh, speaking in February at the Air Force Association's Air Warfare Symposium in Orlando, announced a series of changes in the works for the NCO corps that would hopefully aid airmen in making sure they focus on job performance while also getting the right professional military education.

Welsh said airmen would be required to complete an associate's degree, through the Community College of the Air Force or another institution, and enlisted airmen must attend Airman Leadership School

then the Noncommissioned Officer Academy (for senior NCOs, they will have to attend the Senior NCO Academy for further development). Both the NCOA and the SNCOA are going to transition to a "blended learning" curriculum in the near future, Welsh said, which will shrink the length of the residence course in both schools and will not repeat material covered in the correspondence portion. Welsh said a beta test of the SNCO Academy correspondence course had run, and both academies would be fully operational with the new program by the end of this spring.

"Everything is connected, from recruitment on," Cody said in March, adding that USAF will be "evolving" PME and it will take several years to get right. "We are bringing the level of learning and comprehension to a much higher level," he said, adding that blended learning also allows the service to be "more predictable" in its PME practices.

While Cody views the debate on the roles and responsibilities as a separate one from the "churn" of the budget now unfolding, Welsh has made no secret his interest in exploring what USAF expects of senior NCOs—to include having them assume billets formerly reserved for officers. "What we are doing is ... opening our aperture to have the discussion about where we think the best utilization of our talents, specifically the talents of our enlisted force, should be," Cody said in March.

Especially over the last two decades, the enlisted realm has "evolved to a much different place than when we first estab-

lished their traditional roles," Cody said. He singled out the 618th Tanker Airlift Control Center at Scott AFB, Ill., as one organization that has already taken some roles formerly performed by officers and placed them under the charge of senior NCOs. While there is no one effort or study looking at these issues, Cody said, the Air Force is having a "broad discussion" about many different mission areas.

"Where it makes sense, we should have a discussion about it," he said. "When you have the right training, education, experience within an enlisted person, why would we not leverage that in roles [that], in history ... were predominantly performed by officers. I think we're at a juncture where [Welsh] would like us to think about it again."

Of course, this debate is also not entirely separated from cost, as Welsh himself admits. "If we can get well-qualified mid- to senior-grade NCOs doing jobs that [company grade officers] are now performing, over the life cycle, the cost of those people is less money. And they are very capable people now," Welsh said during a stop in Japan last August.

As the service takes a hard look at who it wants to stay in the force in the coming years, it needs to think hard about how it utilizes its NCO force, he added.

"They are better educated, they are very capable, ... and we have an awful lot of situations where we have a mid-level officer who will go to a senior NCO to make sure a decision they are about to make is practical, credible ... and then they come back and make that decision. Well, I'm not convinced that senior NCO could not make that same decision," he said. ■

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The US-Japan alliance is mutually reinforcing as China increasingly pushes its military and political power forward.



USAF photo by SrA. Katrina M. Brisbin

The Chinese military strategist Sun Tzu, writing 2,500 years ago, said, “to fight and conquer in all your battles is not supreme excellence; supreme excellence consists in breaking the enemy’s resistance without fighting.”

The People’s Republic of China is applying Sun Tzu’s maxim today in the East China Sea, apparently seeking to drive American forces out of bases on the Japanese island of Okinawa without going to war. China’s leaders have sought to

By Richard Halloran

The US, Japan, ... and China

poke and prod without arousing an armed response from Japan and the US.

By doing so, China has been testing the half-century-old military and political alliance between Japan and the US. Officers on both sides say it’s a solid alliance, even if it requires daily maintenance due to differ-

Top: Japan Air Self-Defense Force airmen prepare an F-2 for takeoff during the multilateral exercise Cope North 2014 at Andersen AFB, Guam. Left: Japanese MSgt. Hiroshi Moriyama, a loadmaster, guides a forklift out of a C-130 at the airport on Rota, an island in the Northern Marianas. Airmen from Japan, Australia, and the US performed a humanitarian relief mission on the island—during Cope North—when the island’s governor declared a state of emergency.



USAF photo by SrA. Marianne Santos

ences in culture and language. Politically, though, the partnership is hampered by stagnant Japanese politics and American preoccupation with its own political and economic problems.

One step at a time, China has moved to pressure Japan. It claimed the uninhabited Japanese-held Senkaku Islands in the East China Sea—pinnacles of rock that the Chinese call Diaoyu. China has declared an air defense identification zone adjacent to Japanese islands and waters. It has sent bombers flying through those same areas and scrambled fighters to monitor Japanese and US aircraft. The Chinese have steamed coast guard vessels inside Japan's 12-mile limit and sailed warships and submarines through Japan's southern archipelago to reach the open waters of the Pacific.

Toshi Yoshihara, a scholar specializing in Chinese maritime issues at the Naval War College in Rhode Island, says China intends to “induce caution, to induce hesitation” by Japan and the US, which is obligated by treaty to help defend Japan. A naturalized US citizen, Yoshihara says China seeks to avoid a “decisive battle” with Japan and the US by forging an “incremental strategy.”

The target of this strategy is evidently the Ryukyu island chain, which stretches 650 miles from the southern tip of Japan's island of Kyushu nearly to Taiwan, the self-governing island claimed by Beijing. Okinawa is the largest and most important isle in the Ryukyus and is the site of Kadena Air Base, the hub of US airpower in the western Pacific.

The Chinese Communist Party's newspaper, the *People's Daily*, laid out Beijing's objectives on the Ryukyus, asserting that the islands “were not historically part of Chinese territory” but constituted “an independent kingdom that paid tribute to China.”

Japan annexed the islands in 1879 during the Meiji Restoration, which propelled the then-feudal nation into the modern world. Japan retained control of the islands after World War II ended in 1945. The *People's Daily* suggested that China would seek to revive the Kingdom of the Ryukyus, known in Chinese as Liu Chiu, and bring them once again under Beijing's controlling influence. The issue is “an unsolved historical problem,” the newspaper said.

In a background conversation, a political advisor to Japanese Prime Minister Shinzo Abe said last fall that Abe took the

Chinese threat to the Ryukyus seriously and sees it as a long-term objective of Beijing. A Japanese military officer with access to intelligence assessments said his country is keenly aware of China's intentions. Both asked not to be named because of the sensitivity of the issue. The Japanese government's most recent National Defense Program Guidelines assert that the Japan Self-Defense Forces (JSDF) would “develop full amphibious capability in order to land, recapture, and secure without delay in case of any invasion to any remote island.”

A SERIOUS COMMITMENT

Col. Marc Reese, a senior officer in the strategy, plans, and programs staff at USAF's Pacific Air Forces headquarters in Hawaii, declined to talk specifically about China's strategy but noted: “This is not new; the Chinese have done this before.” With a nod to Sun Tzu, he said, “We have to be students of history.”

When President Barack Obama was in Tokyo in late April, he sought to deter China by asserting that the US commitment to Japan's defense was “absolute.” Noting that the US-Japan security treaty “preceded my birth,” the President said it specifically covered the Senkaku islands claimed by China but administered by Japan as part of Okinawa prefecture.

Earlier that month, Defense Secretary Chuck Hagel met with his Japanese counterpart, Defense Minister Itsunori Onodera, in Tokyo, offering reassurances that the US would support Japan in a conflict with China. The low-key US response to Russia's Crimean land grab in March had worried Japanese leaders. Hagel underscored his assurances by revealing plans to increase the number of Navy Aegis cruisers deployed to Japan from five to seven.

Their mission: Build up ballistic missile defenses in the western Pacific. “We take seriously America's treaty commitments,” Hagel said.

Hagel's trip continued to China, where he was greeted by a testy article in Xinhua, the state news agency. “As the new Defense Secretary, Hagel has to be informed of some basic facts,” Xinhua wrote. “In fact, the growing assertiveness of Japan could be partly attributed to the United States. Irresponsible remarks by some US politicians have emboldened the rightist forces in Tokyo.”

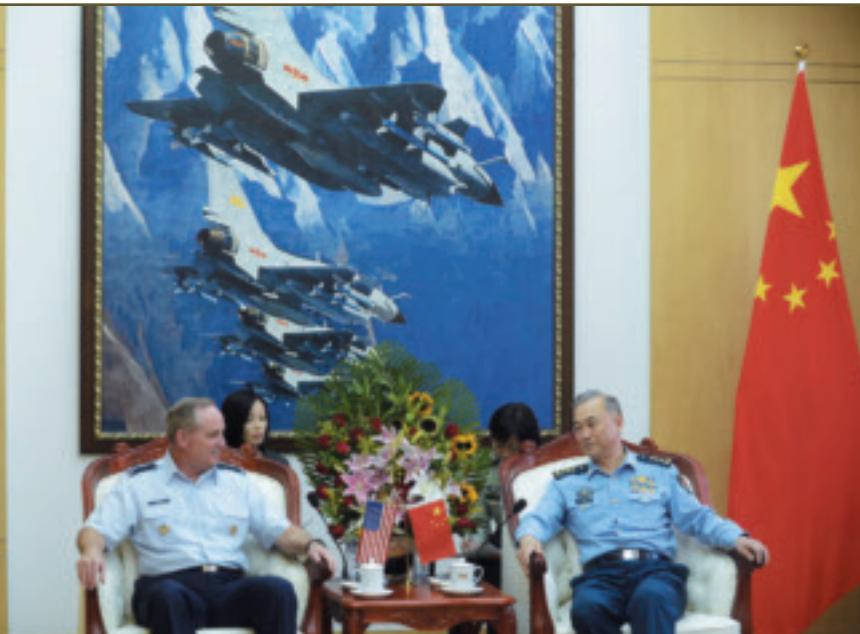
Then, a vice chairman of the Central Military Commission, which governs the People's Liberation Army, told Hagel that China was “dissatisfied” with his comments in Japan. Gen. Fan Changlong contended that Hagel's remarks to “Japanese politicians were tough—and with a clear attitude.” The Minister of Defense, Gen. Chang Wanquan, was even more pointed, emphasizing that “China has indisputable sovereignty” over contested islands in the East China and South China Seas. He added: “We will neither compromise on, concede, or trade on territory and sovereignty nor tolerate them being infringed on even a little bit.”

Hagel, after an address at the PLA's National Defense University, was the target of questions accusing the US of taking sides with Japan against China. “You're using such issues of Diaoyu Islands and the South China Sea issue,” said one officer, “to make trouble for China to hamper its development.”

Joseph A. Bosco, a former China country director in the Pentagon, pointed to Beijing's moves to claim most of the South China Sea and occupy islands claimed by the Philippines, Vietnam, and other nations in Southeast Asia.



US Secretary of Defense Chuck Hagel tours China's Non-commissioned Officer Academy in Beijing, accompanied by Chinese military officers. Chinese officials were unhappy with Hagel's remarks in Japan, and let him know it.



USAF photo by Scott M. Ash

US Air Force Chief of Staff Gen. Mark Welsh III (l) meets with the chief of China's air force in Beijing last September. The two generals are seated beneath an enormous painting depicting China's most advanced operational fighter, the J-10.

Writing in *Politico*, Bosco said that “China is obviously betting that Washington will not have the means or the will to mount a sustained resistance to aggressive Chinese moves in the South China Sea, East China Sea, Taiwan Strait, and Yellow Sea.” He argued that “China, following the teachings of Sun Tzu, thinks and plans for the long haul and prides itself on patience, perseverance, and wearing down the will of its opponents.”

Caution is needed, suggested Denny Roy, a senior research fellow at the East-West Center, an educational institute in Honolulu. “Some Chinese are talking about prying the Ryukyus away from Japan,” he said. “This is not officially announced PRC policy, but such talk naturally alarms the Japanese.”

In a wider context, Roy said many Chinese “have an inchoate desire for a degree of control over the area immediately around China.” He said this is partly due to “the sense of insecurity inculcated by the ravages of the ‘Century of Shame’” in which European powers, Japan, and the US occupied parts of China until 1949. It was also “partly because China has been the region’s dominant power through much of history and Chinese see this as the natural order.”

The Chinese concentrate military attention on Kadena because they perceive it to be the base of a prime aerial threat. Kadena is home to the 18th Wing, a large and diverse combat unit. It comprises two F-15 fighter squadrons; an air refueling squadron of KC-135s; E-3 AWACS; intelligence and communication units; rescue

and medical evacuation operators; and maintenance and civil engineer squadrons. Tenants include special operations forces. Altogether, 8,000 USAF personnel are posted to Kadena, 40 percent of all those assigned to PACAF. About 4,000 Japanese also work on the base.

In addition, combat squadrons regularly rotate to Kadena from the US for four-month deployments. In mid-January, 12 F-22 Raptors from JB Langley-Eustis, Va., flew to Kadena with 300 airmen to train with the US squadrons and Japan’s Air Self-Defense Forces. The JASDF has 20 combat aircraft stationed at the nearby Naha Air Base, which scrambles alert aircraft in response to Chinese incursions. The JASDF is planning to move four of its 13 E-2C early warning aircraft from Misawa Air Base in northeastern Japan to Naha to add patrols over the southwestern chain of islands, according to Japanese press reports.

For 10 years, USAF has been rotating B-52 and B-2 bombers and accompanying tankers through Andersen AFB, Guam, to maintain the nation’s continuous bomber presence in the Pacific. Reese said these rotations were intended not only for training but for “messaging,” to reassure allies and deter potential adversaries.

The operations of these 113 aircraft have not escaped the eyes of the People’s Liberation Army Air Force, which mounted 333 aerial patrols over the East China Sea during 2013, according to the *Liberation Daily*, an official publication of the PLA. Chinese political and military spokesmen regularly complain about USAF and JASDF

flights, especially regarding intelligence missions flown out of Kadena.

The *People’s Daily* contended that “the primary source of incursions was flights by the ferret aircraft from Kadena, which usually conducted reconnaissance in the exclusive economic zone just beyond China’s 12-nautical-mile limit. This reconnaissance was probably aimed at acquiring the operating frequency of radar stations on the coast or the offshore islands of China, as well as plotting the network of radio communication stations along the coast. It might also be intended to identify the location of some radar stations and electronic units that were not yet ready for use or had not yet entered service.”

Viewed from the perspective of a Chinese operations officer in the Nanjing Military District on China’s coast, US airpower in East Asia might be alarming. To his left front are USAF F-16s based at Osan Air Base and Kunsan Air Base in South Korea, some 600 miles from China’s capital in Beijing. The F-16s at Misawa, Japan, are 1,300 miles from Beijing. To his front would be Kadena, key to the entire array—450 miles from China’s coast and 510 miles from China’s leading port, Shanghai. To his right, but at some distance—1,850 miles—is Guam, where the Air Force and other services have gradually expanded their presence.

FARTHER ON

US aircraft carriers operate in the seas east of Taiwan, as they have in past crises. In Southeast Asia, the US has signed an agreement with the Philippines to regain access to bases in the one-time US colony. Access has been granted by Thailand, a treaty ally. B-52 bombers have begun rotations to Darwin in northern Australia, where they are within striking distance of China’s vital shipping lanes through the South China Sea.

In Japan itself, US and Japanese officials seek to improve already effective working relations. The PACAF commander, Gen. Herbert J. “Hawk” Carlisle, told interviewers at an Air Force Association symposium in Los Angeles, “We are doing much closer coordination on air and missile defense with the Japanese to deal with a wider spectrum of regional threats.”

In March 2012, USAF’s 5th Air Force and the JASDF stood up adjacent air operating coordination centers at Yokota Air Base, west of Tokyo. The centers are equipped with compatible computers so that both can view a common picture. US and Japanese officers need only walk a few steps to confer. “That makes daily coordination much easier, and routine,”

said Reese, who served in Japan before coming to PACAF.

The concept was tested in December 2013. At the bilateral AOCC, 5th Air Force and the JASDF supported operation Yama Sakura, an annual weeklong exercise for ground troops in northern Japan. American and Japanese airmen were tasked to integrate intelligence, plans, operations, and airlift. A 5th Air Force report said the airmen used “real-time three-dimensional mapping” to generate tasking orders.

About the same time, the Japanese government released a policy statement noting that a national security council had been organized and a national security strategy had been established. The statement set a tone by saying: “The security environment around Japan has become increasingly severe as represented by nuclear and missile development by North Korea.” The national defense program set priorities, one of which was “ensuring maritime and air superiority” over the southwestern islands.

Subsequently, Japan’s Foreign Ministry issued updated guidelines on Japan-US defense coordination in peacetime, during an attack on Japan, and “in areas surrounding Japan,” implying North and South Korea, China, and Taiwan. The guidelines called for an increase in “information and intelligence sharing” and policy consultations on “as many levels as possible and on the broadest range of subjects.” In the event of an armed attack on Japan, such as the southwestern chain of islands, “Japan will have primary responsibility” to repel the assault. The US, the guidelines said, “will provide appropriate support to Japan.”

The guidelines, issued after close consultation with US officials, underscored the interlocking nature of US-Japan military operations. The forces of the two nations “will conduct effective joint operations” of their ground, maritime, and air services, the guidelines said.

In an apparent acknowledgement that combined US and JASDF assets in Japan may not be sufficient, the guidelines said: “The United States will introduce reinforcements in a timely manner, and Japan will establish and maintain the bases to facilitate these deployments.” Command and control will be mounted from a “bilateral coordination center” deep underground in the Defense Ministry’s Tokyo headquarters, with spaces ready for US liaison officers.

To prepare for joint operations, the training of US and Japanese aviators goes on at local, regional, and national levels, Reese said. Sometimes US F-16s train with Japanese F-2s, which are similar to F-16s. The US and Japanese pilots sometimes fly

in concert and sometimes against each other as they practice defending Japan.

Some drills have Americans flying out of Kadena to Japanese bases in Kyushu, Japan’s southern island; Honshu, Japan’s main island; or Hokkaido, Japan’s northern island. Last year, USAF invited the JASDF and the Royal Australian Air Force to fly to Guam for Cope North exercises that included both combat drills and disaster relief.

The JASDF also recently participated in a demanding Red Flag drill in Alaska. That particular exercise included pilots and aircraft from South Korea—noteworthy because the South Korean government and press in recent months have stirred up long-standing animosities toward Japan.

On the ground, Japan’s Western Army in Kyushu has been training two regiments in amphibious operations with an assist from the US Marine Corps. This has been a new venture because Japan has not had marines since World War II. The regiments comprise 1,200 to 1,500 soldiers, what Americans might call an oversized battalion. Japan’s most recent defense budget also calls for buying V-22 Osprey tilt-rotor aircraft like those the Marine Corps launches from the Navy’s amphibious ships.

The JSDF conducted a large amphibious exercise last summer called Dawn Blitz in which 1,000 Japanese soldiers were moved by ship to “invade” San Clemente Island off the coast of California. Then they boarded ships to “invade” Camp Pendleton, the US Marine base in California.

Col. Grant Newsham, a Marine Corps liaison officer, said, “The JSDF did the necessary staff planning and coordination, as well as the necessary logistics work, and conducted these operations with modest US assistance.” He said the JSDF flew four helicopters without incident off US Navy ships. The Japan Ground Self-Defense Force demonstrated an ability to coordinate naval gunfire, helicopter attacks, and mortar fire.

The biggest shortcoming of the operation was in communications, but the Maritime Self-Defense Force and the GSDF “managed to jury-rig a communications network,” Newsham said, adding that communications with US forces “needs improvement.”

In early 2014, another exercise called Iron Fist brought 250 soldiers from Japan’s Western Army to Camp Pendleton, Calif., to be paired with Marine reconnaissance teams, snipers, and amphibious trainers.

While the US and Japanese military services have been gradually moving ahead in joint training and operations, it remains to be seen whether the two nations’ political leaders will act against threats from China, North Korea, or elsewhere.

In Tokyo, political leadership has been moribund for 25 years. During that time, 17 prime ministers have held office, most for little more than a year. The exception was Prime Minister Junichiro Koizumi, who was in office from 2001 to 2006.

Abe came to office in late 2012 promising to lead Japan out of the pacifism that has been the hallmark of his nation’s stance on security since its defeat in World War II. He pledged to revise Japanese policy so that Japan’s forces could engage in “collective security.” Under the US-Japan security treaty, the US is obligated to defend Japan, but Japan is not obliged to defend the US.

The prime minister has suggested that Japan spend more for defense. As a matter of policy—not law—defense spending has been held to one percent of gross national product for decades. Abe has indicated that he’d like to amend the constitution’s famed Article Nine, which forbids Japan from using force as an instrument of national policy. Abe has set up a national security council, patterned after that of the US, to pull together the agencies concerned with security. Obama’s national security advisor, Susan E. Rice, and Abe’s first national security advisor, Shotaro Yachi, agreed in Washington in January “to frequent regular communications” between the two staffs.

In Abe’s national security strategy, he states that since the end of World War II, “Japan has adhered to a basic policy of maintaining an exclusively national defense-oriented policy, not becoming a military power.” Further, the document declares, Japan has contributed to stability in Asia “by enhancing its alliance with the United States.”

The Abe Cabinet has also relaxed a decades-old ban on arms exports, which may give Japan a bit more clout with Asian neighbors. Even so, much remains to be done before Abe can claim to have reformed Japan’s security posture.

A key facet of Obama’s foreign policy since late 2011 has been the rebalance of focus on that region. In his State of the Union address in January, however, Obama favored his domestic agenda and gave short shrift to foreign policy and security except for a discussion of the Middle East and Iran. He barely mentioned Asia.

Japan, not at all. ■

Richard Halloran, formerly a New York Times foreign correspondent in Asia and military correspondent in Washington, D.C., is a freelance writer based in Honolulu. His most recent article for Air Force Magazine, “Friends or Allies?” appeared in the December 2013 issue.

For decades the Air Force has hosted field museums at bases around the country. They range from small buildings to elaborate parks with many large aircraft on static display. Their funding has often been precarious, however, and in recent years their money problems have been worsened by the long recession and shrinking defense budgets.

The museums are popular: In Fiscal 2013, the 14 field museums reported more than 1.5 million visitors, not including visitors at the five Air Force heritage centers for which attendance numbers aren't available. Combined, their attendance matches or exceeds that at the National Museum of the US Air Force at Wright-Patterson AFB, Ohio.

The field museums don't just restore and preserve scarce aircraft and

artifacts. They offer orientation for airmen and the public, serve local school districts, host base-level military functions, and provide a window for the public on Air Force missions and activities.

The program grew rapidly in the 1980s, as various commands and bases established museums, helped in part by Cold War budgets. From the outset, NMUSAF (then known as the Air Force Museum) cautioned local commanders and curators that it wouldn't fund or staff field museums. Still the field museums grew, fueled by dedicated staff, volunteers, and nonprofits.

Field museum funding is provided by the owning organization (typically an air base wing or operational wing) and supported by nonprofit foundations created specifically for this purpose. The local base entity provides staffing,

to include the director/curator, who is a government employee or military member. Major command history offices oversee the field museums and other heritage activities.

In three decades of operations, some trends have emerged. The most visited field museums are located on base property, close to the perimeter, allowing visits that don't affect base security. Nonprofit foundations have embraced their role as "the museum's ATM card," as one field museum foundation member put it, enabling staffs to plan and execute programs for the good of the museum and the service.

Sticking to a disciplined story line pertinent to each museum's mission statement has proved useful when funds are tight and the displayed aircraft must be maintained in a way that reflects credit on the Air Force. That obligation is codified in Air

Museums and Money

By Frederick A. Johnsen

The Air Force's field museums are under financial pressure as they explore new ways to use their amazing icons to engage the public.



Three B-25 bombers fly over the National Museum of the US Air Force at Wright-Patterson AFB, Ohio, during a commemoration of the 1942 Doolittle raid over Tokyo.



USAF photo by TSgt. Jacob N. Bailey



Force Instruction 84-103, guiding field museums.

As the Air Force wrestles with downsizing and sequester, however, the field museums will likely come under increasing financial pressure. As official USAF entities, the museums don't charge admission to help cover their expenses.

Each museum's supporting foundation helps, but the level of fund-raising support varies from one to another.

The budget for the Air Force Flight Test Museum at Edwards AFB, Calif., was frozen last year—not counting facilities or salaries for two staff—and so was that of the Air Force Armament

Above: A modified Wright B Flyer is maintained at Texas Air Museum in 2010 in preparation for flyovers and festivities commemorating the Centennial of Military Aviation in Fort Sam Houston, Texas. Below: The fuselage of the B-17 Swoose arrives at the restoration facility at NMUSAF near Dayton, Ohio. Swoose is the only B-17 D model in existence.



Museum at Eglin AFB, Fla. At Hill AFB, Utah, some \$239,000 that had been requested for maintenance of display aircraft and grounds, to comply with inspection demands, wasn't available. Sometimes, year-end fallout funds—dollars not spent elsewhere by the owning organization—get put back on the museum account, but this is no substitute for a reliable budget.

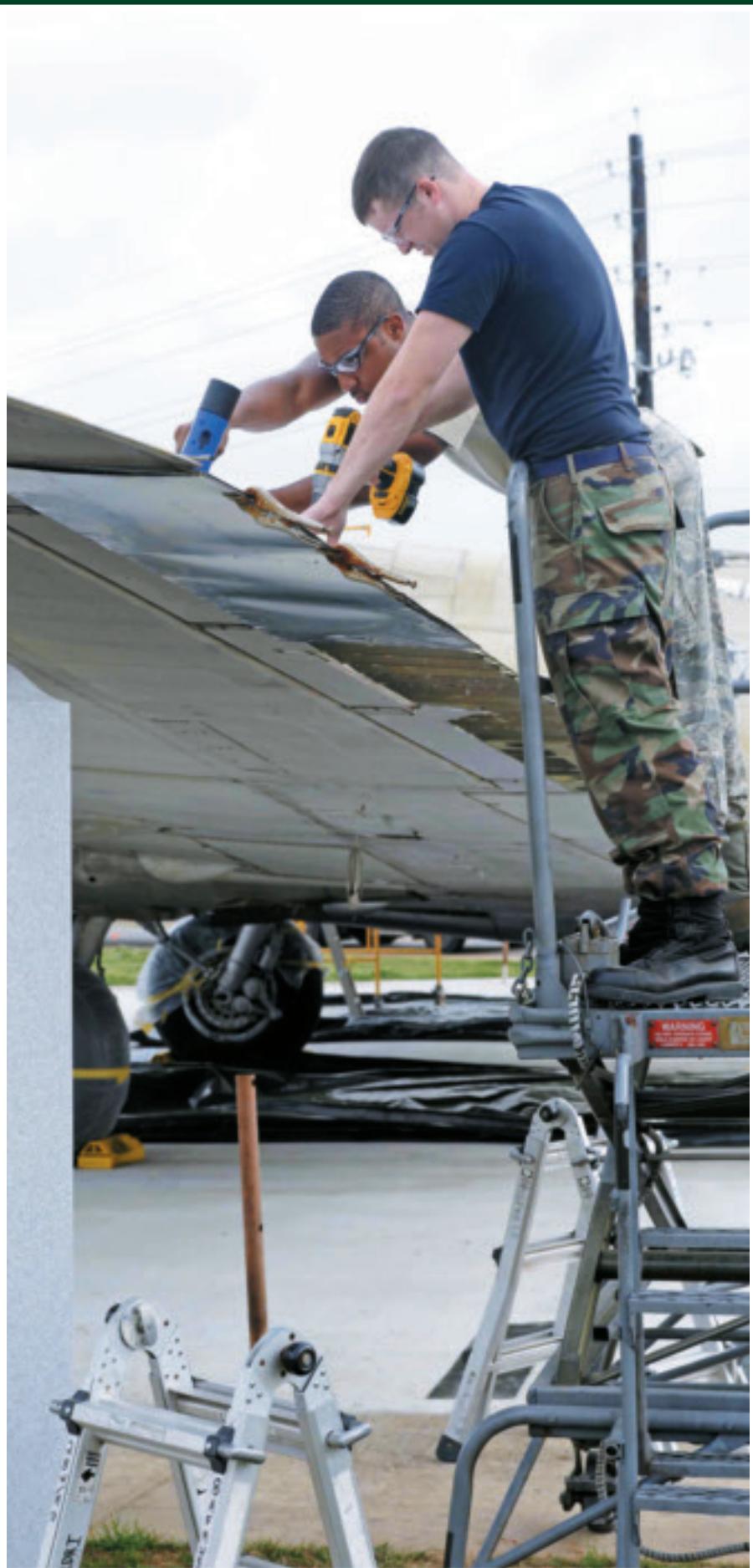
The largest of the field museums, the Museum of Aviation at Robins AFB, Ga., had its 16-member government staff halved in 2011, under an Air Force Materiel Command-wide downsizing of 4,500 civilian billets under the Global Base Support initiative. When the Robins staff was cut, it was necessary to tag a third of its 32 aircraft as "excess."

REHOMING CLASSICS

NMUSAF owns the hundreds of aircraft and thousands of historical items housed at the field museums and steps in at times like these and tries to find new homes for the excess aircraft. An HH-43 helicopter from Robins, for example, was transferred to the McChord Air Museum at JB Lewis-McChord, Wash., and an F-94 was loaned to the civilian Castle Air Museum, adjacent to the former Castle AFB, Calif. A group of three jets and a helicopter went to the civilian Pacific Aviation Museum on Ford Island at JB Pearl Harbor-Hickam, Hawaii, and a WB-57F was actually returned to operational use with NASA.

Shifting budget priorities threaten the artifacts, however. NMUSAF can't afford to take on the additional cost and responsibility of maintaining all the field museum collections if field museum funding dwindles too much.

A1C Bronson Bohannon (r) and A1C Avondries Green install rivets on a new sheet of metal for the B-17G they are restoring for the Global Airpower Museum at Barksdale AFB, La. The museum was formerly known as the Eighth Air Force Museum.



USAF photo by Ssgt. John Gordnier



While selective downsizing can be accommodated by placing historic aircraft with other museums, a draconian budget cut could overwhelm this process, putting at risk both valuable aircraft and the goodwill and reputation of the Air Force.

While NMUSAF owns the artifacts, the Air Force History and Museums Program, working through curators in each major command, oversees the field program. Local commanders are responsible for keeping their museums and heritage centers in shape. While each of these agents places expectations on the field museums, their day-to-day survival depends on the professionalism and dedication of the staff—often only one or two deep.

NMUSAF dedicates some staff to helping the field museums acquire appropriate aircraft and displays on loan from its own holdings, but the field museums have to pay for the transportation. In an effort to equip newer field museum staff with fundamental curatorial, collections management, and exhibiting skills, NMUSAF schedules workshops

for field staff on behalf of the Air Force History and Museums Program.

What does the future hold for these outposts of Air Force heritage?

James R. Frank Jr., of the Air Force History and Museums Program, doesn't see any radical shifts in the field museum activities.

"The Air Force heritage program structure is likely to remain unchanged as we look forward," said Frank, who is manager for field museums. "When we address budgetary and resource issues, we need to get creative in how we overcome those obstacles."

PRESERVING HERITAGE

Frank lauded the "commitment and contributions our historians, curators, and archivists show ... in our museums and heritage centers throughout the Air Force. These folks are essential to ensuring the Air Force story is told not only to our airmen but also the public."

Some in the field program have lobbied for stronger advocacy and even central funding for key field museums as regional adjuncts to the Air Force

Museum. Retired Lt. Gen. John L. "Jack" Hudson, director of NMUSAF, said it's a partnership effort between his central organization and the field museums to collect, preserve, and interpret.

"Both the NMUSAF and the field museum program perform a vital mission in communicating the Air Force story to internal [USAFAF] and external [public] audiences," he said. "Our collaborative stewardship allows field museums and heritage centers to focus on highlighting local and regionally based missions while the NMUSAF presents the comprehensive Air Force story from its beginnings to today."

Though operationally and administratively separate, "we work together to present Air Force history and heritage," he said.

To adapt to leaner times, various approaches are being examined. One alternative is to model the museum enterprise after the National Park Service. It has limited story line exhibits for the public and active programming, but doesn't have to curate large collections that demand manpower, resources,

Above: The Strategic Air & Space Museum, adjacent to Offutt AFB, Neb., has 3,000 square feet dedicated to promoting aviation and aerospace education.

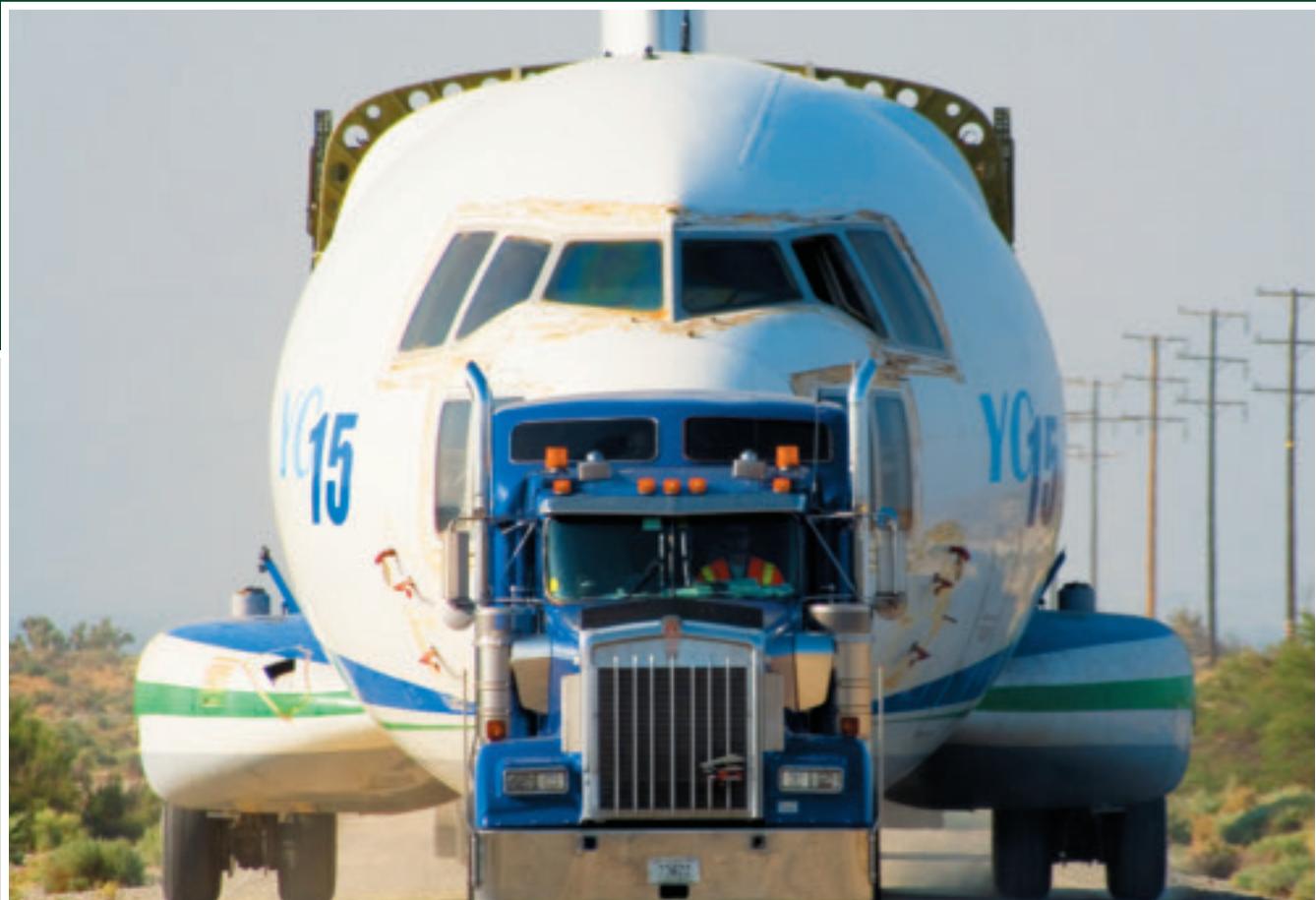


Photo by Frederick A. Johnsen

and space. Under this model, the field museums would focus more on supporting the local command and on-base population.

That approach doesn't sit well with Kenneth R. Emery II, director of the Museum of Aviation at Robins. While Emery sees service to the Air Force as vital, he said, it's only one part of what the museum does.

"Our airmen are woefully ignorant of their rich heritage," he said. "We need to show them their lineage, show them where they come from and what they're capable of doing. Aircraft, equipment, and personal items that were actually used in Air Force operations offer powerful, tangible connections to the courage, tenacity, ingenuity, skill, and sacrifice of our airmen."

Such objects "and the people stories associated with them" can inspire and educate "in ways that photos, text, and video alone cannot," he said. It's just as crucial to tell the Air Force story to the public.

"Many people simply do not know what the Air Force has done and is now

doing. So it's not just about telling Air Force history. We have to show and tell about current roles, missions and contributions," he explained.

While NMUSAF's sprawling facility at Wright-Patterson tallies as many as 1.3 million visitors annually, Emery argues that that's not enough to get the Air Force story out.

"The reality is that, for most people around the nation who visit an Air Force field museum, it is the only Air Force museum they will ever visit," Emery said. "Many airmen can go an entire career without ever visiting NMUSAF. The field museums offer a great opportunity for the Air Force to bring our story to more of our airmen and the public."

Museum staffs will have to find a new balance, tempering the urge to acquire new aircraft and artifacts with the sobering cost of maintaining them during lean times. Field curators and

directors will have to find inventive and economical ways to maintain their collections so they can grow and adapt to best tell the museum's story.

Hudson sees some opportunities amid these challenges. One of them is online. NMUSAF uses the Internet to bring a virtual museum presence to millions of visitors; nearly four million visits were tallied in 2013. Field museums can put exhibits and educational opportunities online inexpensively, "and most are within the reach of each and every field museum and heritage center," Hudson said. Going online offers "a totally new dimension to the field programs."

The cautions from NMUSAF at the inception of the field museum program—that the field facilities needed to be self-sufficient—are unequivocal. Sequestration forced the museum itself to curtail operations; it was closed during the 2013 government shutdown. ■

Frederick A. Johnsen is the former director of the Air Force Flight Test Museum at Edwards AFB, Calif., and helped create the McChord Air Museum, Wash. His latest article for Air Force Magazine, "Warbirds," appeared in the January issue.

Above: A massive YC-15 arrives at the Air Force Flight Test Museum at Edwards AFB, Calif. in 2008.



ENEMIES FOR HIRE

By Walter J. Boyne

Sometimes, the best “Red Air” comes from the private sector.

FIGHTER pilots have been practicing air combat maneuvering—dogfighting—since 1914. Most air forces have some kind of formal dogfighting instruction, and most fighter pilots do it on their own—frequently against regulations and often with casualties. It was not until the Vietnam War, however, that systematic air combat maneuver (ACM) training was introduced using aircraft with dissimilar performance.

Formal schooling was established for dissimilar air combat tactics after Vietnam, but it wasn't until the early 1990s that private firms were attracted to provide DACT as a commercial service.

Increasingly, these firms provide many types of DACT at far lower cost than the military services can achieve on their own. Most of the activities don't involve “Red on Blue” dogfights, although these receive the most attention. Because the types of services vary widely, so do the companies offering to support this training, and the government can benefit from the intense competition.

Since the first air battles in 1914, air forces have been curious about the “other guys’” airplanes. These early encounters quickly generated reports on enemy per-

formance and tactics that were studied by the respective air forces and industries on both sides. Contemporary magazines, such as Britain's *Flight Magazine*, printed numerous insightful analyses of enemy aircraft, including three-view drawings and detailed sketches of technical innovations.

Both sides repaired and flew captured enemy aircraft, often to practice friendly air combat. A few pilots, such as German ace Rudolf F. O. Windisch, who earned 22 victories, went further. For his sixth kill, Windisch shot down a French SPAD S. VII, flown by Portuguese Captain Oscar Monteiro Torres. Windisch had the SPAD repaired and painted it red, replacing Allied markings with German insignia. Then he flew it in combat, reportedly liking it better than his own government-issue Albatros D.V.

In truth, the Albatros and the SPAD were similar in performance and that remained the case in fighter adversaries for decades. The major powers competed in a cyclical fashion, with one nation one-upped by another, such as Britain's Hawker Fury bested—temporarily—by Russia's Polikarpov I-16. Smaller countries such as Czechoslovakia, Poland, and



Romania, too, created indigenous aero industries producing competitive aircraft. When World War II began, the Luftwaffe's Messerschmitt Bf 109 and the Royal Air Force's Spitfire set the standard, but other countries soon caught up.

During World War II, testing opposing aircraft reached an industrial level; the Luftwaffe had the Zirkus Rosarius, which operated a varied fleet of captured Allied aircraft that were sometimes used in combat by the special operations unit Kampfgeschwader 200. Britain tested captured German aircraft from the start, with its No. 1426 (Enemy Aircraft) Flight. The US tested aircraft at several Stateside facilities and participated in four Allied Air Technical Intelligence Units to evaluate Japanese aircraft.

It wasn't until late in World War II that a large disparity in fighter performance was created by the arrival of the German Messerschmitt Me 262 jet fighter. Ad hoc tactics were quickly developed, but this was on-the-job training, not course work. Had it appeared a year earlier, the Me 262

might have made a temporary difference in the European air war, but there were too few and it was too late to make a significant impact.

By the time the Korean War began in 1950, the need for DACT seemed to disappear as Russian MiG-15s battled the US F-86. The performance of the two jets was comparable, though each had advantages over the other.

PROJECT RED BARON

It wasn't until Vietnam that it became urgent to train pilots in DACT, where the performance of the opposing aircraft varied markedly. High-performance US fighters such as the McDonnell F-4 and Republic F-105 were pitted against older North Vietnamese MiG-17, -19, and -21, fighters. On paper, there should have been no contest: Only the MiG-21's performance was in any way competitive with that of its American opponents.

Unfortunately, given the nature of the US offensive mission and the onerous rules of engagement under which it was flown, North Vietnam was able to dictate tactics and rack up an alarming number of kills using its combined limited airpower and integrated ground-based air defense system. During Operation Rolling Thunder—from March 2, 1965, to Oct. 31,

1968—almost 1,000 US aircraft were lost, about one per day.

The air-to-air kill ratio in the Korean War was thought to have favored the US at a rate of roughly 10 to one. The kill ratio in Vietnam, however, sank to 1.1 to one; and even this number was in doubt. Both the Air Force and the Navy knew that the situation had to be corrected.

The Navy responded first, with a report by Capt. Frank W. Ault indicating that the low kill ratio was caused by insufficient training in ACM. The Navy's Fighter Weapons School was established at NMAS Miramar, Calif., on March 3, 1969; it later became world famous as the "Top Gun" program.

Initially, the Navy operated Douglas A-4 Skyhawks and Northrop T-38 Talons to simulate the characteristics of the MiG-17 and MiG-21, respectively. It also used some Grumman A-6 Intruders and Convair F-106s.

The program was immediately successful, as the Navy's kill-to-loss ratio rose to 13 to one after 1970. DACT has since become basic to naval flight training.

In 1996, Top Gun was incorporated into the Naval Strike and Air Warfare Center at NAS Fallon, Nev. There are four classes a year, each lasting nine-and-a-half weeks for nine Navy and Marine Corps strike fighter crews. Top Gun also supports other agencies of NSAWC, including a lecture series that runs concurrently with the strike training for entire air wings.

The Navy has several other adversary squadrons stationed around the country. Many other air arms, including those of the US Army, Argentina, Britain, Canada, Greece, Israel, France, Netherlands, Pakistan, Russia, and Turkey have specialized units with similar functions.

The Air Force took much longer to respond to the situation as it conducted an intensive study called Project Red Baron. This analysis of air combat over Vietnam revealed three main problems USAF crews faced: (1) they were not seeing the enemy until he fired his guns—a poor way to begin a battle; (2) they did not know enough about enemy pilots, their airplanes, or their tactics; and (3) they believed that air superiority was a given and hadn't been trained to fight an enemy equipped with dissimilar machines.

In effect, the air war in Vietnam was on-the-job training.

One important finding of other studies of that time was that, after 10 combat missions, a pilot or weapon systems officer's odds of surviving later battles rose dramatically.

Left: An ATAC Kfir and two Hunters perform "Red Air Force" duties over San Clemente Island, Calif., during a command and control exercise in 2013. **Below:** A Draken TA-4K and an MB-339 on a radar intercept training mission.



Photo by Jose Ramos



Photo by Jose Ramos

Several companies emerged in the US and elsewhere to supply essential elements of training at a lower cost than the services can provide.

One of the most experienced is the Airborne Tactical Advantage Co., with headquarters in Newport News, Va. ATAC has flown more than 35,000 hours in support of US and allied aggressor training and owns a fleet of fighter and attack aircraft. It contracts for more aircraft as required.

Another, a relative newcomer, is Draken International. Draken owns a large fleet of modern aircraft and is focused on the future of DACT—when potential enemies will be generally equipped with fourth and fifth generation aircraft.

The decision to create the intensive combat exercise program that became known as Red Flag was spurred on by then-Maj. Richard “Moody” Suter at Nellis AFB, Nev. The first Red Flag was flown in November 1975, and the 4440th Tactical Fighter Training Group (Red Flag) became operational on March 1, 1976.

Red Flag became a true university of air combat. Relatively quickly, four Aggressor squadrons were formed: the 64th and 65th in the US, the 26th Tactical Fighter Training Aggressor Squadron at Clark Air Base in the Philippines, and the 527th TFTS at RAF Alconbury in England. Northrop F-5Es were chosen to be the initial aggressor aircraft.

The training grew rapidly in depth and breadth and is now the responsibility of the 57th Wing, which handles all aspects of air combat training. The 414th Combat Training Squadron puts together several Red Flag exercises each year, operating Lockheed Martin F-16 and Boeing F-15 fighters to simulate the MiG-29 Fulcrum and the Su-30 Flanker. The aggressor aircraft are painted in colors and markings of foreign users of the competitor aircraft and emulate their tactics, ordnance, and electronic capabilities.

Four major changes affected the world of DACT, opening opportunities for adventuresome entrepreneurs.

First was the appearance of highly sophisticated competitor aircraft, with advanced electronic and ordnance capabilities, teamed with airborne command posts. This made the typical aggressor aircraft of the past unable to simulate a potential enemy’s true capability.

Second was the massive increase in ground support requirements implicit in an aggressor program.

Third was the skyrocketing cost-per-hour to fly modern tactical aircraft. This

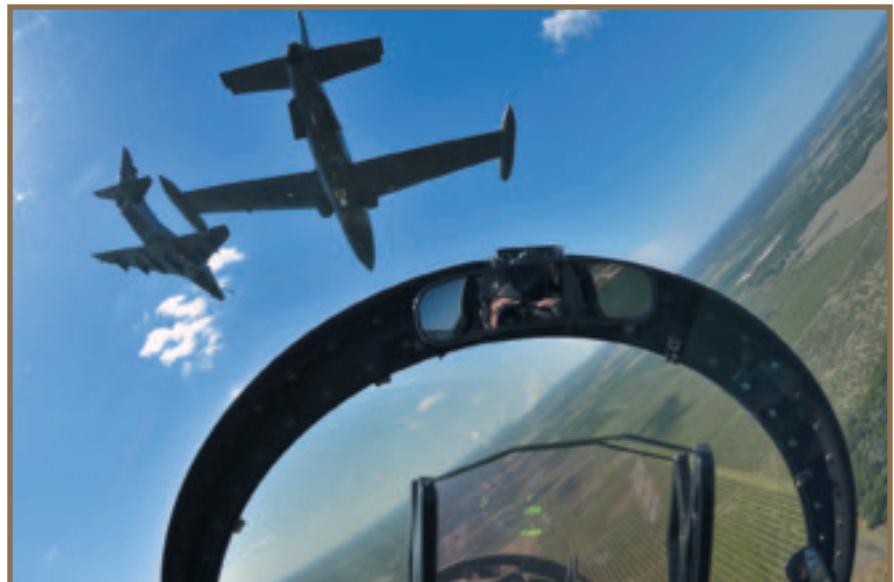


Photo by Jose Ramos

Top: An ATAC Kfir plays aggressor for a 390th Fighter Squadron F-15 from Mountain Home AFB, Idaho, in 2008 during a two-week exercise with the 390th and other squadrons on the base. **Above:** The view from a cockpit of an MB-339 shows two Draken aircraft—an A-4K and an MB-339—on an air-to-ground training mission over Florida in 2013.

factor alone almost prohibited using modern USAF aircraft on missions that didn’t require their top performance.

Last but not least was the cost in airframe life.

Most aggressor missions don’t require dogfighting, but instead involve flying important but relatively simple profiles to test the target acquisition and tracking capabilities of radars, missiles, and aircraft. It would be incredibly wasteful in terms of both hourly flight time costs and airframe hour cost to use Lockheed Martin F-22s against other F-22s in all but the most important tactical exercises.

JOB IT OUT

The significance of these changes was amplified by reductions in the Pentagon budget and by the effects of budget sequestration.

For 20 years, ATAC has provided aggressor services on an as-required basis, boasting savings to its clients of hundreds of millions of dollars. ATAC has a build-it-to-order philosophy that allows it to extend existing capabilities to meet new contractual requirements. It trains Navy, Marine Corps, Air Force, and Army aircrews, ship crews, and combat controllers from six sites around the world. The training includes air-to-air, air-to-ship, and air-to-ground techniques.

For the Navy, these tactical flight services have been integrated into every level of air-to-air operations, from fleet replacement squadrons to Top Gun. For USAF, ATAC has conducted training in F-15 operational readiness evaluations, Red Flag and Northern Edge exercises, and support for training Lockheed Martin F-22 crews. It provided 300 hours per year of

close air support training to US Air Force in Europe's Air-Ground Operations School.

In Asia, ATAC recently completed a first ever two-week deployment to Kunsan AB, Republic of Korea, home of USAF's 8th Fighter Wing. As a guest Red Air Forces player, ATAC deployed two Hawker Hunter Mk-58 aircraft from NAS Atsugi, Japan. They took part in the joint South Korea Air Force-7th Air Force exercise Max Thunder 13-2. The versatile hunters provided adversary support in multiple large force exercises. They flew missions ranging from defensive counterair to low-level strike.

The 8th Operations Group commander at Kunsan, Col. Peter M. Bilodeau, commended ATAC for its professional threat replication to the Blue Air Forces.

The savings provided by ATAC include millions of dollars in training and readiness costs. A less obvious benefit is the life extension this provides for frontline aircraft. For example, in the last two decades the Navy has saved hundreds of millions of dollars with ATAC's aircraft supplanting F/A-18 Hornets in specific training scenarios, according to the company. Using ATAC aircraft saved \$16,000 per flight hour, over the course of 19,000 sorties. Perhaps more importantly, it also saved an average of 130 years of airframe time, assuming that the Hornets would have flown 230 hours per year.

ATAC's fleet of 24 aircraft includes specialized versions of three different fighters, each one capable of executing the specific military requirements called for by a contract. The most important of these are the supersonic, single-seat Israel Aircraft Industries F-21 Kfir, the legendary Hawker Hunter, and the Aero Vodochody Albatros L-39. However, ATAC is engaged with several aircraft vendors so that it can supply other types as needed, including the Lockheed Martin F-16. The firm also supports other aerospace companies in their development programs.

The company attributes its success in part to its rigorous hiring process, recruiting only retired or reserve US fighter pilots with an average of 3,000 hours flying time. More than 75 percent of these hires are graduates of either the USAF Weapons School or the Navy's Top Gun. Maintenance personnel hiring standards are equally high, as the aircraft in ATAC's fleet are the most sophisticated versions of their type, equipped with the most modern electronic and ordnance systems available. ATAC has been able to maintain a 97 percent mission completion rate over its 20-year history.

Draken International operates out of Lakeland, Fla., with a very different

Commercial British Aggressors

In Great Britain, Hawker Hunter Aviation is the only company authorized to provide dissimilar air combat training services to the British armed services and to defense contractors. HHA supplies fast-jet aircraft for work as aggressors in air combat maneuvers, threat simulation, mission support training, photo chase, radar calibration, and other services. HHA also has contracts to operate against Royal Navy ships, testing their defensive capabilities.

HHA took advantage of the Swiss Air Force's decision to retire a fleet of low-hour Hawker Hunters and bought 12 of the versatile aircraft. The Hunters have been equipped with state-of-the-art electronics so that they can replicate 80 percent of all recognized aircraft or missile threats.

Large-scale investments made it possible for the firm to expand its engineering and operational infrastructure to organically operate and maintain its aircraft. It uses the Sukhoi Su-22 to meet requirements for supersonic aircraft and the BAE Buccaneer for long-range work. Aircraft are based at RAF Scampton.

business model. Draken has assembled a fleet of more than 50 aircraft, with more than 80 planned. It claims to be the largest privately owned fleet of military aircraft in the world, and it is focused on the requirements of air forces using fourth and especially fifth gen aircraft.

The Draken fleet includes 11 Douglas A-4K Skyhawks, 27 MiG-21s, nine Aermacchi MB-339s, and five L-39 aircraft. Many of these are equipped with modern electronic equipment. Most are fairly low-time aircraft or have gone through service life extension programs.

Management at Draken states that it offers the only "fourth generation" solution to the industry, claiming a cost effectiveness of four to five times that of using service aircraft. Although its fleet is not fourth generation, it offers a wide spectrum of services.

Draken contends that the military services should concentrate their limited flight time—and airframe life hours—on Blue Air capability and outsource the adversary stand-ins. The business case depends on shrinking budgets for frontline jet flying hours, a model that has been borne out in recent years.

While Draken emphasizes joint tactical air combat training, it also offers airborne adversary support, aerial refueling of its own and other aircraft, threat simulation, and other missions as required. Beyond just training functions, Draken offers research and development capabilities in the form of weapon carriage, photo chase, High-Q testing, and radar testing. It also provides support for remotely piloted aircraft opera-

tions and space missile defense testing. The firm says the main difference between itself and its clients is the lower cost at which it can provide these functions.

Like ATAC, and most of the other commercial adversary firms, Draken recruits top quality personnel. The pilots are military-trained and many are Red Flag or Top Gun graduates. Ground personnel are equally experienced.

Draken and ATAC are the bookends of the commercial aggressor training spectrum. In between there are a number of other aggressor companies, such as Discovery Air Defense Services of Canada or Hawker Hunter Aviation in Great Britain. Each firm has its own style, business model, and philosophy.

The future is bright for such companies and other new entrants in the field. First is the rising cost of new equipment, in the form of the F-35 Lightning, JAS 39 Gripen, Eurofighter Typhoon, Sukhoi T-50, or Chengdu J-20. These new fighters are getting very expensive for any air force to use in many training roles, both in flight hour and in airframe hour cost.

Moreover, there are myriad possibilities for combat, ranging from small actions against terrorist operations to full-scale wars between major powers. This calls for a wide array of threat aircraft, armed with a variety of ordnance and the necessary support personnel equipment to be used in many different training scenarios. As a result, there will be opportunities for entrepreneurs to offer specialized training solutions for far less than the respective air forces could provide.

Walter J. Boyne, former director of the National Air and Space Museum in Washington, is a retired Air Force colonel and author. He has written more than 400 articles about aviation topics and 29 books, the most recent of which is Beyond the Horizons: The Lockheed Story. His most recent article for Air Force Magazine, "The Checklist," appeared in the August 2013 issue.

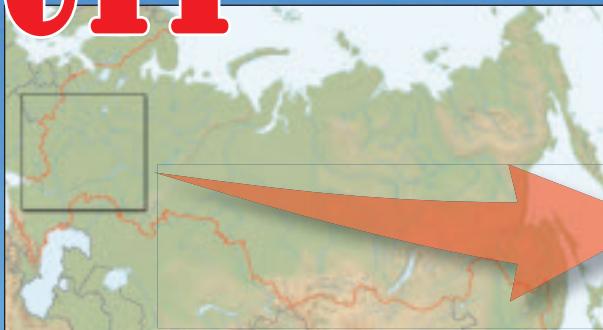
RUSSIAN AIRPOWER

Photography by Aleksey Mikheyev

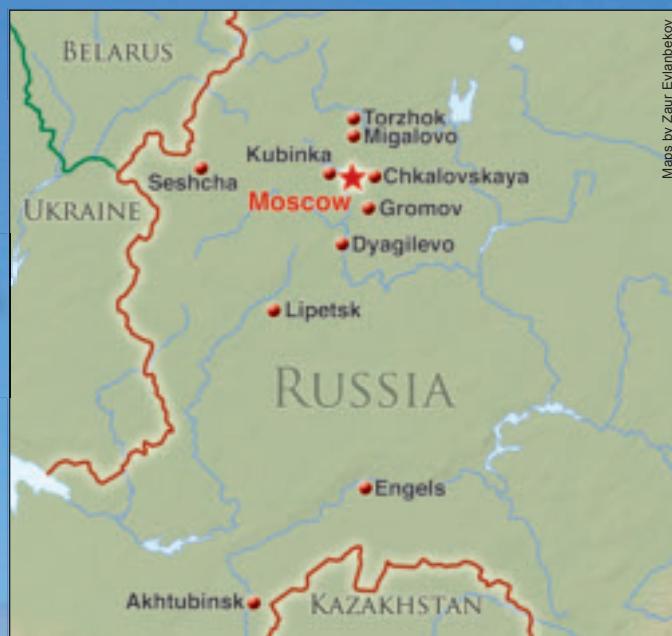
Russian aerial power could overwhelm its European neighbors.



2014



This feature depicts aircraft from various air bases located in the western part of Russia.



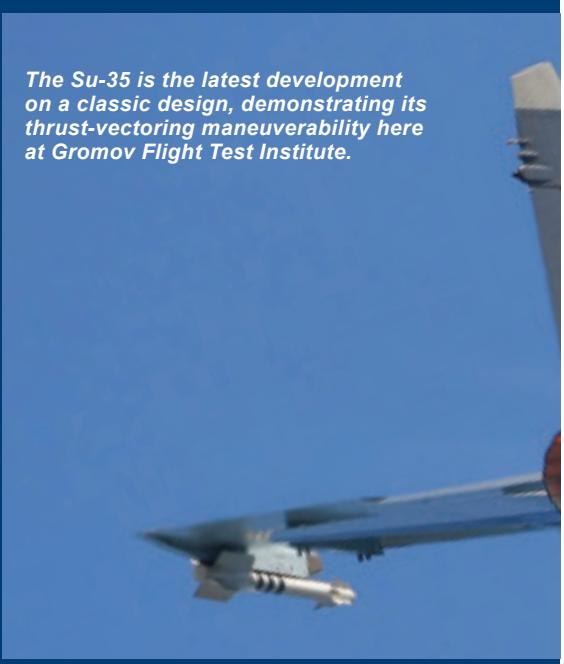
Russia's annexation of Ukraine's Crimean peninsula, massing of military forces along the border, and stoking internal unrest in Ukraine have ratcheted tensions between Russia and the US and NATO allies to a post-Cold War high. The Russian military is in the midst of a massive modernization effort to replace the bulk of its aging hardware with modern weapons systems, with an emphasis on Russia's strategic nuclear force. Russian air forces are central to President Vladimir Putin's push to project Russian power within the former Soviet sphere and around the world. Here, weapon handlers prepare to load S-13 air-to-ground rockets on an Su-24M strike aircraft for a live-fire exercise at a training range in Lipetsk. An Su-24 made several "provocative" low-level passes over the destroyer USS Donald Cook in the Black Sea in April, sparking sharp words from the Pentagon.



Ground crew tow a Forepost, which is a license-built copy of an Israeli remotely piloted aircraft called Searcher, at Kubinka Air Base, highlighting Russia's efforts to enhance joint battlefield capabilities, something sorely lacking in the past.



A well-bundled crew chief waits to recover an Su-24M fighter-bomber after a training sortie from Lipetsk Combat Training Center.



Weapons technicians transport a pair of R-27R radar guided missiles, which are standard air-to-air armament for Russian fighter aircraft.



Escorted by a MiG-29, this II-80VKP aerial command post is one of four based at Chkalovskaya near Moscow. Like USAF's E-4B, the aircraft is equipped for secure communication with ballistic missile submarines.

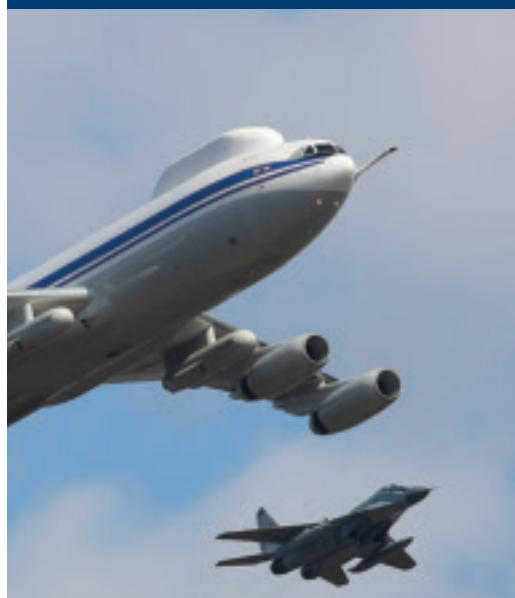




The Migalovo-based Antonov An-22 Antheus heavy transport is the largest propeller-driven military aircraft in service worldwide.



The Yak-130 prototype, shown here on a test flight, was developed in partnership with Italy as a light-attack aircraft and trainer.



The Russian air force is constantly upgrading its Il-20 electronic intelligence-gathering platforms, such as the two seen here earlier this year at Kubinka (foreground). The colorful Su-27 in the background is part of the Russian Knights flight demonstration team.



A Beriev A-50 AWACS shows off its freshly painted red stars on a post-upgrade flight from Gromov in 2013.



Based at Seshca, An-124 heavy airlifters such as this one are capable of carrying even the largest military payloads. NATO countries contracted civilian-owned Antonovs to haul equipment and material to Afghanistan.



The prototype for Russia's newest fighter, the advanced Sukhoi T-50, performs an "ascending cobra" while showing off its maneuverability during an aerial display over Gromov in 2013.



The Kamov Ka-31 was designed to provide ship-borne early warning for the Russian fleet.



A ground crew prepares to launch a MiG-31 on a training sortie from Lipetsk. The nearly Mach 3-capable aircraft was designed to intercept high-speed targets and has little competition for speed today.



A coaxial-rotor Ka-52 Alligator attack helicopter based at the Russian Army's Torzhok combat weapons center is armed with a 30 mm cannon and rocket pods to provide realistic training for air crews. It is seen here during exercises at the Kushalino range.



The Su-34 fighter-bomber, seen here taxiing at Lipetsk in 2010, was designed to replace the legacy Su-24.



A crew chief marshals an Su-34 fighter-bomber at Lipetsk in 2009. The aircraft is capable of delivering an array of the latest weapons.



A MiG-29K fighter configured for naval use approaches the Indian Navy carrier INS Vikramaditya during carrier acceptance trials in 2013. Russia ordered the type last year to equip its sole conventional-capable carrier, Admiral Kuznetsov.



An airman inspects a Mi-28N helicopter rotor head before takeoff at Torzhok Airfield in April.



A fearsome Mi-28N attack helicopter silhouetted at low level during maneuvers.



A T-50 advanced fighter prototype at Gromov in 2012.



A swing-wing Tu-22M3 supersonic bomber armed with a long-range Kh-22 nuclear-capable cruise missile.



An Engels AB-based Tu-160 supersonic strategic bomber, known as "White Swan" in Russia, lifts off from Kubinka AB. Russia has recently announced plans to develop a fifth generation bomber.



Ground crew repack fighter drag-chutes left by aircraft taxiing off the runway after landing at Lipetsk.



An aircrew inspects the weapons, sensor suite, and equipment of an Mi-28N attack helicopter before a sortie at the Torzhok tactical training center earlier this year.

An Mi-8MTV2 (foreground) and an Mi-8MTV5, variants of the venerable 'Hip' tactical support helicopter, lift off during exercises at Torzhok in March.



A MiG-31B heavy fighter-interceptor escorts an A-50 AWACS during a formation demonstration in 2010.



A pair of Su-25 attack aircraft from Kant Air Base pound practice targets on the Edelweiss range in Kyrgyzstan. The Su-25 is Russia's premier close air support platform and saw use by both Russian and Georgian forces during the 2008 war.



Germany was disarmed after World War I, but nevertheless found ways to rebuild its combat airpower.



By John T. Correll

THE SEMI-SECRET BIRTH OF THE LUFTWAFFE



Photo via Bettmann/Corbis

German Chancellor Adolf Hitler (front, left) and Air Minister Hermann Goering (front, right) inspect a new squadron at Doeberitz in 1935. The pilots had trained earlier in civilian flying clubs.

HTHE terms of surrender at the end of World War I were hard on the German armed forces, especially on the Imperial German Air Service. The Treaty of Versailles in 1919 imposed a limit of 100,000 on Army strength and reduced the Navy to 36 ships.

The air force, however, was demobilized completely, stripped of its airplanes and forbidden to obtain or possess any more. Even the hangars were torn down.

In 1922, Allied inspectors certified the German air force as disarmed. As late as 1932, Chancellor Heinrich Brüning complained that Germany was still defenseless in the air.

All the more wonder that when, in March 1935, Chancellor Adolf Hitler announced that Germany was rearming, he also revealed that a substantial "Reichsluftwaffe" already existed. (The first part of the new name did not last for long.)

Air Minister Hermann Goering boasted to the press that his Luftwaffe air fleet had parity with Britain's Royal Air Force. It wasn't so, but it upset the British. Prime Minister Ramsay MacDonald said the air strength of the home force would be built up to the German level. As Goering spoke, 400 aircraft, including bombers and fighters, flew over the Air Ministry in central Berlin.

At the beginning of 1935, the Luftwaffe consisted of 20 staffeln (the approximate equivalent of squadrons) with 11,000 members and 1,800 aircraft (including 370 bombers, 250 fighters, and 590 reconnaissance aircraft). The numbers grew steadily.

From 1936 to 1939, the Luftwaffe was engaged in the Spanish Civil War, thinly disguised as the "Condor Legion" and flying such world-class combat aircraft as the Bf 109 fighter and the Ju 87 Stuka dive bomber. By 1939, the Luftwaffe was ready to lead the blitzkrieg that opened World War II.

Obviously, the disarmament of Germany and the abolition of the German air force had not worked out as expected by the Allies. Through a combination of deception, evasion, and enterprise, the Germans had laid the way to rearmament while the rest of the world looked on. Their adversaries in Europe were more shocked than they had any real right to be.

Versailles

In the fall of 1918, after four years of war, Germany's military position had become hopeless. The Kaiser was forced into exile and an interim parliamentary government asked for an armistice, which went into effect on Nov. 11. The victorious Allies dictated the terms, no questions permitted.

The armistice required the German army to retreat beyond the Rhine while the leaders of the Allied nations met in Paris to determine the details of the surrender. Curiously, the Germans were not disarmed right away. That did not begin until 1920. For more than a year, Germany continued to produce and export munitions and war materiel. Among its principal trading partners were the Netherlands and Russia.

The Paris Peace conference was dominated by the "Big Three"—French Premier Georges Clemenceau, British Prime Minister David Lloyd George, and US President Woodrow Wilson—who decided personally on the terms to be imposed.

Twenty-seven nations sent delegates to Paris, but most of them only attended



The decisions at Versailles were made personally by the “big three”—British Prime Minister David Lloyd George (l); French Premier Georges Clemenceau (second from right) and US President Woodrow Wilson (r). Other Allied leaders also attended, such as Italian Premier Vittorio Orlando (second from left), but had little input.

a weekly “plenary conference” that discussed the issues but made no decisions. Russia had dropped out of the war when the Bolsheviks made a separate peace with Germany after the 1917 revolution. Therefore, Russia was not a party to the conference in Paris.

The Treaty of Versailles was presented as an ultimatum and the Germans signed it with gritted teeth on June 28, 1919. Among other things, they were required to acknowledge “the responsibility of Germany and her Allies for causing all the loss and damage” of the war, which had been caused “by the aggression of Germany and her allies.”

The “guilt clause” went down hard. Germans of every station believed that the treaty was unjustified and unfair, that the war had been forced upon them. Military leaders and hardliners cultivated the fable that Germany had not been truly defeated, that the army had been sold out by the parliamentary government. Prominent promoters of this fiction included Gen. Erich F. W. Ludendorff and later, Adolf Hitler.

Allied forces occupied all of the German territory west of the Rhine, plus several bridgeheads on the other side of the river. In addition, a demilitarized zone was established on the east bank of the Rhine, 30 miles deep and running from the Netherlands south to Switzerland.

Despite this, the Allies had been careless in drawing up the treaty and the clamps on Germany were not as tight as they looked. Except for occupation of the Rhineland, there were no effective means to enforce compliance. There was

no occupation of Germany at large. The Allied inspection teams monitoring the disarmament were small and limited in their authority. The Germans evaded them with ease.

The Allies differed greatly in their postwar priorities for Europe. The French wanted to keep the Germans as militarily weak as possible. The British, interested in maintaining a balance of power, did not want the French to become too dominant. The main issue for the United States—or for Woodrow Wilson, anyway—was creating the League of Nations.

Woodrow Wilson’s Obsession

At Wilson’s insistence, the very first thing in the Treaty of Versailles—ahead of the surrender terms—was the “Covenant of the League of Nations.” In somewhat awkward language, Article 10 of the treaty vested the League with the decision on when and how to respond to international aggression.

Wilson was playing a lone hand. He had not consulted Congress about the negotiations in Paris and he ignored the advice of his own secretary of state. He expected Congress to ratify the treaty without argument.

Also at Wilson’s instigation, the military provisions of the treaty led off with a statement of general disarmament: “In order to render possible the initiation of a general limitation of the armaments of all nations, Germany undertakes strictly to observe the military, naval, and air clauses which follow.”

Wilson crafted this astounding passage as a gesture to make the treaty more

amenable to Germany. However, it also reflected his famous “Fourteen Points,” proclaimed in 1918. Point No. 4 had called for “national armaments reduced to the lowest point consistent with domestic safety,” and the closing lines after the numbered points said that, “We have no jealousy of German greatness. ... We do not wish to injure her or to block in any way her legitimate influence or power. ... We wish her only to accept a place among the peoples of the world—the world in which we now live—instead of a place of mastery.”

Wilson disclosed the provisions of the treaty to the press before discussing them with congressional leaders and then, to Wilson’s surprise, Congress refused to ratify the treaty. The primary objection was the League of Nations committing US forces to war without a vote by the US Congress. However, Wilson’s arrogant style was a factor as well.

The United States withdrew its members from the Allied inspection teams and had no further part in overseeing the disarmament. However, the notions and statements Wilson had embedded in the Treaty of Versailles would loom large in Germany’s declared justification for rearmament.

The Allies Bamboozled

The US departure left enforcement of the treaty essentially up to the British and the French. Anxious to address long-neglected domestic problems at home, they put only limited effort into monitoring German disarmament. There were three “control commissions” with 1,200 inspectors for land forces, 450 for air forces, and 200 for naval forces. The aeronautical commission went out of business in 1922, certifying that disarmament of the German air force was complete.

The land force inspectors, poorly supported by their governments, were hampered by German obstructionism and refusal to cooperate. Physical attacks on the inspectors led to nothing more severe than a demand for apology and fines for those guilty of the assault. The Japanese naval air attaché in Berlin warned the Germans when a plant inspection was scheduled. In 1925, the Allies gave up altogether on inspections and turned responsibility for violations of the Versailles Treaty over to the toothless League of Nations. Allied occupation forces withdrew from the Rhineland in 1930, ahead of schedule.

Germany had entered World War I with a large military reserve, built

up by the regular infusion of draftees who remained in the mobilization base after completing their initial training and service. To prevent this happening again, the treaty set the minimum period of enlistment for privates and NCOs at 12 years. Officers had to "undertake" to serve at least 25 years.

Maj. Gen. Hans von Seeckt, commander of the Reichswehr ("State Security"), managed to use this restriction and the army strength limit of 100,000 to his advantage. He weeded out all except the best qualified, who became the cadre for a larger force. Each man was ready to assume the duties of higher grades whenever the opportunity came for the force to expand. Von Seeckt called it a "fuhrerheer" or an "army of leaders." Training standards were the toughest in the world.

In signing the force disbandment order in 1920, Von Seeckt vowed, "We shall not abandon hope one day of seeing the flying corps come to life again." Over the objection of the personnel office, he kept 180 former flying officers in his officer corps of 4,000. He also assigned an air officer "special duty consultant" to each of the seven infantry divisions.

Because of a gaping loophole in the treaty, Germany was not forbidden to produce war materiel outside of Germany. Krupp, Heinkel, Junkers, Dornier, and other firms soon set up factories and subsidiaries abroad in Sweden, Finland, the Netherlands, and Russia. Inside Germany, Krupp made "agricultural tractors," which in actuality were experimental tanks.

Germany was allowed to manufacture civilian aircraft after 1922, but with tight constraints on size, speed, and payload. These limits were rescinded in 1926 after the Germans, invoking a clause of the agreement that imposed the same standards on all aircraft operating in the country, threatened to apply the rule to British and French airliners. Germany's own airline, Lufthansa, established in 1926, effectively operated as a full partner of the Reichswehr.

Airpower in the Shadows

In 1924, the Germans opened a secret air base in Russia at Lipetsk, some 300 miles southeast of Moscow. The Russians, shut out of the Treaty of Versailles, felt no obligation to their former Allies in the West who now treated them as hostile. Besides, Russia needed the technical and financial aid that Germany offered.

Fifty Dutch-built Fokker D.XIII fighters, bought by the German army on an

order routed through Argentina, were based at Lipetsk. The German airmen received their mail by way of a postal box in Berlin and got their supplies in unmarked containers. Eventually some 150 fighter pilots were trained at Lipetsk. The Germans also tested prototypes and conducted tactical experiments at the base, which remained in operation until 1933.

The Germans were permitted to build and fly gliders. Sports flying was also allowed after 1923. The Reichswehr promptly funded the first 10 sports flying schools from its secret budget and enthusiastic young Germans flocked to join private paramilitary flying clubs. There were 300 such clubs with 30,000 members in 1935 when Goering merged them into the German Air Sports Association with himself as chairman.

Glider flying, ostensibly a sport, "sharpened German thinking in aerodynamics, structural design, and meteorology," said historian Edward L. Homze. Willy Messerschmitt began by building gliders and sailplanes and moved up to sports planes. He worked out the key elements of his fabled Bf 109 fighter in the earlier Bf 108 sports and touring aircraft.

The Germans grew steadily bolder. By 1929, eight aircraft plants were operating in the country. There were plenty of customers. Heinkel, for example, sold floatplanes in Japan and the United States. Based on specifications from the Reichswehr Ordnance office, Heinkel, Dornier, and other companies were developing bomber and fighter prototypes and testing them at Lipetsk and at a remote World War I airfield in Mecklenburg in northern Germany.

By 1932, the German air force in the shadows had 550 pilots and 228 airplanes, of which 36 could be classified as military aircraft. Its first fighter, the He 51, appeared in 1932. It was an open-cockpit biplane, supposedly a trainer, but it was used effectively for ground attack in the Spanish civil war.

Demand for Rearmament

Field Marshal Paul von Hindenburg, 78, chief of the general staff during World War I, was elected president of Germany's Weimar Republic in 1925. Hindenburg pointed to Wilson's Fourteen Points and to the general disarmament clause in the Treaty of Versailles and complained that none except Germany had given up their arms.

The German public, resenting the restrictions imposed at Versailles, supported the ongoing but illegal rearmament. The 10th anniversary of the treaty in 1929 was observed as a national "Day of Mourning," with protests against the "untruths" of German guilt and calls for an end to the penalties.

In September 1930, Nazi leader Adolf Hitler predicted that his party would gain a majority of the vote in three or four years and would then tear up the Versailles Treaty. The German press said that Germany had been misled into signing the treaty by Woodrow Wilson and his Fourteen Points.

Chancellor Heinrich Bruening asserted in 1932 that disarmament had led to an "impossible situation," leaving Germany defenseless. "Heavily armed nations" had the advantage, he said "especially in air arms."



Maj. Gen. Hans von Seeckt (front) converted restrictions into advantages, using the personnel ceiling to weed out all but the best performers and building a strong cadre from which the force could expand.



Designer Willy Messerschmitt began with gliders, sailplanes, and sports planes. He worked out key details for his Bf 109 fighters in the earlier Bf 108 "sports and touring" aircraft, such as the one shown here after making a belly landing in Czechoslovakia in 1941.

Germany sent an "Arms Equality Memorandum" to France, declaring that "all categories of arms which are not generally banned through convention must be permitted for Germany, too."

Western animosity diminished with the passage of time. It became popular to believe the war had been caused by a convergence of complex international conditions and that no nation should have been singled out for blame. Germany's desire for the capability to defend itself seemed reasonable.

Gen. Douglas A. MacArthur, US Army Chief of Staff, was not alone in his opinion in 1934 that the Versailles Treaty was a "gross injustice" and that Germany had the right to rebuild its military force.

Breakout

Rearmament shifted into high gear in January 1933 when Hitler was appointed chancellor by Hindenburg. Hitler named a German war hero, Hermann Goering, as Reich commissioner of aviation. As a World War I aviator with 22 aerial victories, Goering won both the Iron Cross First Class and Prussia's highest military decoration, the "Blue Max." In the final months of the war, he succeeded the "Red Baron," Manfred von Richthofen, as commander of Jagdgeschwader 1, the "Flying Circus."

In March 1935, Hitler announced that Germany was rearming, with "sufficient instruments of power not only to maintain the integrity of the German Reich but also to command international respect and value as co-guarantor of general peace." He said that Germany had "grounded arms" unilaterally in 1918 because of a treaty that was "one-sidedly imposed and executed." He also cited misplaced trust in the promises of Woodrow Wilson.

The Reichswehr was redesignated the Wehrmacht. The German army would have 36 divisions—about 500,000 men—making it the fourth largest in the world.

Hitler confirmed the existence of the Luftwaffe, revealed as an independent air arm on a par with the German army and navy. He told English visitors that the Luftwaffe was already the size of the RAF, but he was counting unarmed trainers as combat aircraft. The propaganda ministry proclaimed that the Luftwaffe would put "a steel roof over Germany" that would "darken the sun." At the beginning of 1935, it had about 1,800 aircraft in service. The Luftwaffe was emerging as an air force of significance, but it was not yet the powerhouse the Nazis claimed.

Goering was promoted to Reich air minister and commander of the Luftwaffe. "The Luftwaffe was favored at its birth by the fact that its patron and first leader, Hermann Goering, was Hitler's right-hand man," said historian Williamson Murray.

German aircraft production soared from a total of 36 in 1932 to 5,606 in 1937.

The output included modern combat aircraft: The He 111 medium bomber had been disguised as an airliner when it was designed in the early 1930s; the Messerschmitt Bf 109 was the world's most advanced fighter when it first flew in 1935; the fearsome Ju 87 Stuka dive bomber also made its debut in 1935.

When Germany reoccupied the Rhineland—which had been demilitarized by the Versailles Treaty—in 1936, the Luftwaffe sent two squadrons of He 51 fighters. They flew from airfield to airfield, changing their markings at each stop, to give impression of greater numbers. Hitler used the perception of

a large and indomitable Luftwaffe to intimidate the rest of Europe into giving him the concessions he wanted.

Climb to Power

American aviator Charles A. Lindbergh, who had visited Luftwaffe bases several times, reported in 1938 that "without doubt the German air fleet is now stronger than that of any other country in the world." It was also unmatched in the depth of its combat experience.

In July 1936, Hitler sent military help to Gen. Francisco Franco, leader of the fascist revolutionaries in Spain. Twenty Lufthansa Ju 52 airliners, repainted to conceal their origin, airlifted Franco's forces from north Africa to the fighting front in Spain. The Ju 52s were then reconfigured as bombers.

The Germans soon upgraded their involvement to the "Condor Legion," which consisted primarily of aircraft, aircrews, and ground crews from the Luftwaffe. Over the next three years, about 19,000 German military members saw duty in Spain, serving one-year rotational tours. They wore khaki-brown uniforms with Spanish rank insignia, which fooled nobody.

Spain was the combat debut for three aircraft—the Messerschmitt Bf 109 fighter, the He 111 medium bomber, and the Ju 87 Stuka dive bomber—which would later play important roles in World War II. For the Luftwaffe, it was a dress rehearsal for a larger war.

By 1939, the Luftwaffe had about 3,500 aircraft and 20,000 flying personnel. It was especially strong in fighters and its main weakness was the lack of long-range heavy bombers.

The Condor Legion returned from Spain May 28, 1939, and was reviewed by Hitler in a massive victory parade in Berlin June 6. Four months later, on Sept. 1, 1939, Hitler invaded Poland to begin World War II. The invasion, which introduced the operational concept of blitzkrieg or "lightning war," was led by waves of Luftwaffe Ju 87 Stukas.

As the Battle of Britain in 1940 and subsequent conflict over the European continent demonstrated, the invincibility of the Luftwaffe was exaggerated. Nevertheless, it was a powerful force, built up in amazing time and under difficult circumstances. ■

John T. Correll was editor in chief of Air Force Magazine for 18 years and is now a contributor. His most recent article, "Fear of Fallout," appeared in the April issue.



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THE TUSKEGEE Airfields

By Daniel L. Haulman

Pilots, including squadron commander then-Capt. Benjamin O. Davis Jr. (far left), walk away from their Stearman biplanes near Tuskegee, Ala., during pilot training.



The famous airmen were actually trained at five airfields, surrounding Tuskegee Institute.

The first black pilots in the American armed forces became famous as the Tuskegee Airmen. The 332nd Fighter Group, the only African-American flying group in combat, lost fewer escorted bombers to enemy aircraft than other fighter escort groups in World War II, proving that black aviators could fly and fight as well as their white counterparts.

The name Tuskegee Airmen was taken from the most important of their training bases, Tuskegee Army Airfield, but there were four other fields where they also trained—Griol, Kennedy, Moton, and Shorter Field.

The Tuskegee area of Alabama was chosen for a number of reasons.

First, the flying weather was better on more days of the year than in the North.

Second, real estate was relatively cheap and the airspace uncongested; Tuskegee was a rural area with plenty of land avail-

able for development, and no large nearby cities smoldering with racial tension.

Third, the War Department had decided that the first black military pilots would be assigned to segregated units, and segregation was already part of the local culture.

Tuskegee Institute's president, Frederick D. Patterson, actively lobbied for his school to be the center of black military pilot training. It was already training black civilian pilots and nourished a reputation as one of the foremost African-American institutions of higher learning in the country. Even if it got an Air Corps contract for just the primary phase of black military pilot training, the school would benefit, and construction of a large Army airfield nearby would help the town and county.

At first, many leaders of the National Association for the Advancement of Colored People (NAACP) opposed the Tuskegee flying training program, precisely because it was segregated.

USAF photo





Capt. Roy Morse leads a group of Tuskegee airmen in a class learning to send and receive Morse-coded messages.

Ultimately, though, the NAACP's leaders supported the Tuskegee program, because they preferred that the black pilots be trained in Alabama, and be assigned to segregated flying units, than not be trained at all.

Black pilot training at Tuskegee Institute had begun in 1940, with the Civilian Pilot Training Program. For that purpose, the institute bought and improved a small private airfield called Kennedy Field, about five miles south of the school. The field was only 55 acres, and had no paved runways, but there were four small hangars, populated with Piper Cubs and Waco biplanes.

MORE ROOM NEEDED

Charles A. Anderson—called “Chief” by the other fliers because he was the chief flight instructor—led a team of seven flying instructors: three black and four white.

The most famous event at Kennedy Field was the March 29, 1941, visit by Eleanor Roosevelt, the wife of President Franklin D. Roosevelt. Anderson took her for a flight, and she became an avid supporter of black flying training at Tuskegee Institute. She sponsored fund-raising to build a larger airfield north of Tuskegee, where the primary phase of military pilot training could take place. By then, the first black flying unit, the 99th Pursuit Squadron, had been activated at Chanute Field, Ill., but had no pilots. They were to be trained at Tuskegee.

Second Lt. LeRoy Battle prepares for a training flight at Moton Field, Ala. In 1945, Battle would serve in the European theater.

in September 1941. Today, Moton Field is an airport and home of the Tuskegee Airmen National Historic Site.

Many visitors, before they read the exhibit text carefully, imagine that all Tuskegee Airmen flying training took place at Moton Field, but it only hosted the primary flying training phase. During that phase, cadets flew PT, or primary training, aircraft. Moton Field had PT-13 and PT-17 biplanes—identical except for the engine manufacturer—and later the PT-19 monoplane, used at the field by mid-1944. African-Americans came from all over the country to begin their military flying training at Moton Field.

George L. Washington, who headed Tuskegee Institute's Division of Aeronautics, served as general manager at Moton Field. Another civilian, Lewis A. Jackson, who had worked as a flight instructor at the Coffey School of Aeronautics in Chicago, served as director of training. Jackson worked closely with Anderson and other black civilian flight instructors at Moton Field. There were also some white flight



FIVE AIRFIELDS OF TUSKEGEE DURING WORLD WAR II

Name	Kennedy Field	Moton Field	Tuskegee Army Airfield	Grier Field	Shorter Field
Function	Civilian pilot training; War Training Service	Primary pilot training	Basic, Advanced, and Transition pilot training	Liaison pilot training, auxiliary field for TAAF	Practice auxiliary field for Tuskegee Army Airfield
Total Area	55 acres	275 acres	1,681 acres	320 acres	241 acres
Landing Area	Sod, 3 strips. Longest one 1,900 feet.	Sod, all-way. 4,200 x 300 feet.	Four asphalt-paved runways, three 5,000 feet long, one 4,500 feet long, all 300 feet wide.	Turf, all-way. 3,560 x 3,270 feet.	Turf, all-way. 3,560 x 3,270 feet.
Hangars	Four small, largest dimension, 88 feet	Two brick, one 140 x 120 feet, one 130 x 100 feet	Three large, steel and wood, each 184 x 120 feet, each with two 89x20 foot doors	None	None
Other Facilities	Two shops for engine and aircraft repair, gasoline and oil supply.	Two shops for engine and aircraft repair; Gasoline and oil supply; telephone communications, bus and taxi service.	Engine and aircraft repair shops, gasoline and oil supplies, communications, extensive lighting, accommodations (6 officers, 1,000 enlisted), radio facilities, railroad siding, and bus and taxi service.	Wind tee and wind sock.	Wind tee and wind sock.
Location	5 miles SSE of Tuskegee by road, 4 miles by air.	4 miles N of Tuskegee by road; 2.8 miles by air.	10 miles NW of Tuskegee by road; 6.7 miles by air.	6 miles W of Tuskegee Army Airfield.	11.75 miles WSW of Tuskegee Army Airfield.

Source: US Army Air Forces Airport Directory, Continental United States, Volume I (Washington, D.C.: Aeronautical Chart Service, Army Air Forces, 1945).

instructors, some of whom were in the Air Corps, and they commanded the military cadets.

Tuskegee Institute hired the Iowa-based African-American firm Alexander and Repass to construct Moton Field. George A. Reed served as the field's engineer, responsible for the operation and maintenance of the physical plant. He oversaw the building of Moton Field from June to November of 1941, making sure it met the Air Corps' standards for primary flight training.

Like Kennedy Field, Moton Field had no paved runways, but it was much larger, covering 275 acres. It was located about four miles north of Tuskegee and eventually comprised two large brick hangars, two repair shops, and several other smaller buildings. Although owned by Tuskegee Institute, Moton Field served the Air Corps, which provided the airplanes and military officers to oversee the training.

Maj. Noel F. Parrish, a white officer, commanded the field from July 19 until Dec. 3, 1941, when he was succeeded there by Maj. William T. Smith, a West Point graduate. There were several other white officers providing leadership at Moton Field.

Among them were Capt. Harold C. Magoon, Capt. John G. Penn, and 1st Lt. John H. McBeth. Magoon supervised



An aerial view of Tuskegee Army Airfield taken during the late 1940s. Tuskegee was the largest of the five airfields at which African-American pilots trained.

the check rides of the cadets when their primary flight training was complete. Besides Jackson and Anderson, black instructors included Milton P. Crenshaw and Claude R. Platt.

A flying cadet at Moton Field received 60 hours of training in the PT-17 over a course of nine weeks. Each of the next two phases of flight training—basic and advanced—also took nine weeks. In those

Photo via Air Force Historical Research Agency



Some of Class 44-A at Tuskegee Army Airfield. The pilots trained in single-engine and twin-engine aircraft.

phases, other kinds of aircraft were used, and Moton Field was too small to accommodate them. For those phases, black pilots moved to Tuskegee Army Airfield.

Completed around the same time as Moton Field, Tuskegee AAF was the largest of the five fields, covering nearly 1,700 acres. It was about 10 miles northwest of Tuskegee and a few miles northwest of Moton Field. Tuskegee AAF eventually included four large intersecting paved runways and three large double hangars, each 184 by 120 feet. The field comprised extensive barracks and other buildings like those at other Army Air Forces installations. Unlike Kennedy and Moton Fields, Tuskegee Army Airfield was owned by the Air Corps, which built and operated it directly, instead of under contract with Tuskegee Institute.

Tuskegee Army Airfield was a first in another way; not only was it the first major base for basic and advanced military flight training of African-American pilots, but it was also the first major Army Air Forces base built by a black construction company: McKissack and McKissack. The project cost \$1.5 million dollars, a huge sum at the time. Engineers had to reshape the land to overcome terrain and drainage problems.

On Aug. 6, 1941, a Tuskegee Army flying school was activated at Tuskegee Army Airfield with Maj. James A. Ellison

serving as its first commander, but the black aviation cadets hadn't yet begun their training at Kennedy or Moton Fields. On Sept. 19, black enlisted support personnel began arriving at Tuskegee AAF, to join white enlisted personnel who were already there.

It wasn't until Nov. 8 that six of the 13 black flying cadets who graduated from primary flight training at Moton Field arrived at Tuskegee AAF, to begin the next basic phase of flight training, using BT-13 monoplanes. Two days later, the enlisted personnel of the 99th Pursuit Squadron arrived at Tuskegee AAF.

It would be the first black flying squadron, but it didn't have any pilots yet.

With the attack on Pearl Harbor, the US entered World War II on Dec. 8, 1941. That same month, Parrish, who'd been in charge of training at Moton Field, moved to Tuskegee AAF to be director of training.

January 1942 was a crucial month. Five of the six black cadets who'd entered basic flying training graduated to advanced training at Tuskegee AAF. For that phase, they would fly AT-6 aircraft. During the same month, Col. Frederick V. H. Kimble succeeded Ellison as commander of the field and the flying school.

The 99th Pursuit Squadron, which had moved to Tuskegee AAF in November, waited for its first pilots to complete their training. On Feb. 19, 1942, it was joined by a second black flying squadron, the 100th Pursuit Squadron. Neither of the units had any pilots until March 7, when the first class of black military pilots graduated from advanced pilot training.

Class 42-C had only five members, but they included Capt. Benjamin O. Davis Jr., a former West Point cadet whose father was the first African-American general in the US Army.



USAF photo

First Lady Eleanor Roosevelt, an enthusiastic booster of the Tuskegee airmen, is pictured here in a Piper J-3 trainer with Charles "Chief" Anderson, who led a team of seven flying instructors.

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Hangars once at Tuskegee Army Airfield were moved to civilian airports after the base closed. This one is in Clanton Ala.; others are at airports in Montgomery and in Troy. All are still in use.

The first black pilots who graduated from advanced flying training at Tuskegee AAF remained there as they learned to fly P-40s with the 99th and 100th Fighter Squadrons. When those units had enough pilots, they became operational, but weren't immediately sent overseas to take part in combat. Instead, they continued training at Tuskegee until Oct. 13, when the 332nd Fighter Group—the first black flying group—was activated at Tuskegee AAF.

SHUTTING IT DOWN

The 100th Fighter Squadron was assigned to the new group, as were two new black fighter squadrons, the 301st and the 302nd. The 99th Fighter Squadron wasn't assigned to the 332nd when the organizations were at Tuskegee, because it was older than the other units and prepared to deploy for combat first.

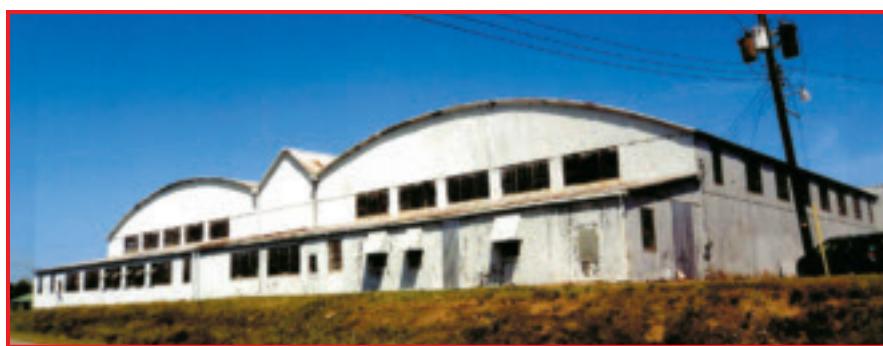
Tuskegee AAF hosted a large number of training and operational aircraft. They included BT-13s for basic flying training, single-engine AT-6s for advanced training of future fighter pilots, twin-engine AT-10s for advanced training of future bomber pilots, P-40s for the 99th Fighter Squadron and the 332nd Fighter Group, and even a couple of B-25 bombers.

In December 1942, Parrish, by then a lieutenant colonel, became the commander of the field and its flying school, replacing Kimble. Parrish was more popular among the black cadets than Kimble, because he relaxed the base's segregation policy. Many white officers served with Parrish in administrative and flying training functions at Tuskegee AAF, but they didn't live on the base with the black cadets. Eventually, African-American pilots—many of whom had gained combat experience in Europe—also joined the training staff. By the time the base closed in 1946, most of the flight instructors at Tuskegee AAF were black.

In March 1943, the 332nd moved from Tuskegee to Selfridge Field, Mich. In April, the 99th deployed from Tuskegee AAF for duty in North Africa. The departure of the four flying squadrons and the group in the spring of 1943 allowed Tuskegee AAF to focus on flying training. The departure of most of the P-40s also freed up room for the training aircraft, though a few remained for transition training.



Photo via Daniel L. Haulman



Forty-four classes of pilots completed advanced training at Tuskegee AAF, but not all of them became fighter pilots after completing single-engine training. Twin-engine pilot training commenced at Tuskegee AAF in September 1943, even as single-engine training continued.

When the 332nd Fighter Group deployed from Selfridge to Italy, where the 99th Fighter Squadron was already serving, the 477th Bombardment Group was activated at Selfridge. Graduates of twin-engine pilot training at Tuskegee Army Airfield went to the 477th.

In mid-1944, an outdoor entertainment amphitheater opened on the northern edge of the base. Ella Fitzgerald and the Ink Spots were the first performers who played the venue, which later hosted celebrities such as Louis Armstrong and Lena Horne, who proved the most popular.

Tuskegee AAF had two auxiliary fields during World War II. The 320-acre Griel Field, six miles west, trained liaison pilots for the Army. These aviators eventually served Army ground units as artillery spotters and observers. Griel was a grass field with no hangars, barracks, or fuel supplies.

The other auxiliary grass strip was

Shorter Field, a 241-acre plot about 12 miles west-southwest of Tuskegee AAF. It also lacked hangars, barracks, and fuel supplies. Pilots in the advanced phase of training at Tuskegee AAF practiced takeoffs and landings at Shorter Field. It was a destination for pilots from the main base on their first solo flights.

From November 1941 through the end of June 1946, almost 1,000 black pilots had trained at Tuskegee AAF; at that point, the last of 44 pilot training classes there graduated. The war was over, and the need for military pilots plummeted. In June 1947, the facility closed for good when the last unit there was inactivated. Like hundreds of other flying training fields around the country, it was never used again. Its most important buildings—such as the three large double hangars—were dismantled and moved to serve at civilian airports in other parts of Alabama. One Tuskegee AAF hangar stands today at each of three airports at Montgomery, Clanton, and Troy.

The five Tuskegee airfields were indispensable to the war effort; their success forever changed the face of American combat aviation.

Daniel L. Haulman is a historian at the Air Force Historical Research Agency. He is the author of three books, including One Hundred Years of Flight: USAF Chronology of Significant Air and Space Events, 1903-2002. He also has contributed to numerous Air Force publications. His most recent article for Air Force Magazine, "Aberrations in Iraq and Afghanistan," appeared in August 2012.

Swimming in Science

By Peter Grier

AFA's Teacher of the year is Margaret Spigner.

When Margaret Spigner was in high school, the ocean became her playground. That's because her father was in the Navy and they were living at the US Naval Station in Guantanamo Bay, Cuba, where opportunities for land-based excursions ended at the wire fence. So she learned to scuba dive and sail and spent hours exploring Guantanamo's beaches and the waters offshore.

"It's quite interesting tacking a sailboat in front of those monster Navy ships," Spigner said.

One day, while diving, she and her brother realized they were being followed by a barracuda. As they escaped to shore Spigner wondered what had attracted the predator: a fish they'd speared, the vibration of her shaking limbs, or even her beating heart.

The incident hasn't deterred her from going back in the water. Instead,

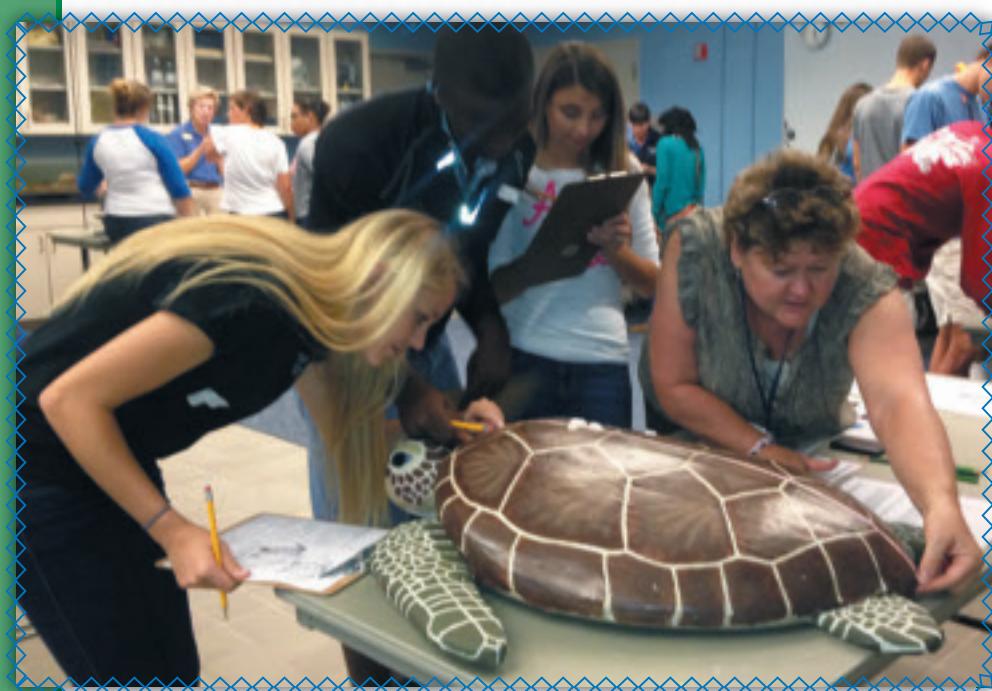
it pushed her to learn more about the water's life. And the more she learned, the more she wanted to tell others; the more she wanted to teach.

"I didn't realize then how much influence my experience with the ocean would have on my career now," she said.

Spigner has been an educator for 31 years. For the last 26 years she's taught marine science, biology, biotechnology, and other science-related classes at what is now West Ashley High School in Charleston, S.C.

Last August the Air Force Association named her the 2013 AFA National Teacher of the Year. AFA cited her for her leadership in science, technology, engineering, and math, her emphasis on real-world learning experiences for her students, and the motivation that has landed her classes more than \$140,000 in grant money during her career.

"This is a true lifelong teacher who is still empowering our students with knowledge and the drive to go on to college and continue the management of the planet," wrote retired Maj. Gen.



Margaret Spigner (right) works with (l-r) Shelby Geiger, Alusine Kamara, and Savannah Canaday on a project at the South Carolina Aquarium.

Arthur J. Rooney Jr., South Carolina State AFA President, when nominating her for the association's award.

Projects are the foundation of Spigner's educational approach. Consider the activities of a recent crop of students, who named themselves the WATER (West Ashley Team of Environmental Researchers) Wildcats, after their feline school mascot.

In 2012 the WATER Wildcats started the year by walking around the school looking for environmental problems to solve. One thing they discovered was that the maintenance crews were using a chemical to aid in scraping wax off floors. The crews then poured the used chemical-wax mixture down storm drains, which led to water detention ponds next to the school building.

"The kids were all, 'Oh, no, our poor fish. We can't let that happen,'" said Spigner.

So they put up signs next to the drains asking workers to refrain from dumping. They planted grasses around the two ponds—which total about three acres in surface area—to slow polluted runoff from reaching pond water.

The crews kept using the drain, though, and other workers kept mowing down their plants. So the students hatched another plan to help the ponds sustain plant and animal life: a floating wetland.

They engineered and built the wetland themselves. It consisted of round, floating circular pods lashed together in the shape of a big paw, in recognition of the "Wildcats" school team name.

"It's really cute seeing it from Google Earth as a paw print on our pond," said Spigner.

One day, disaster struck when a big storm deluged the pond, ripping the wetland loose from the ropes that had been attached to cinder blocks to anchor it at the bottom.

The students themselves had to figure out how to corral the runaway wetland (more ropes and a truck) and how to fix the problem. They engineered a flexible system so that the wetland could rise and fall on its restraints, dependent on water levels.

They then monitored water quality to see how or if the wetland was changing its surroundings. For additional fish habitat, students designed an underwater reef using AutoCAD. They produced a prototype on

a 3-D printer and then tweaked their reef in a 50-gallon fish tank until it achieved optimum attractiveness to fish.

Subsequent classes have continued to work on the detention pond project. This year Spigner's students are constructing small underwater remotely operated vehicles that will be used for pond research, among other things. One ROV will sample water. Another will carry a plankton-catching net. A third will be equipped with a camera so that students can finally see for themselves whether fish are aggregating around the underwater reef.

"The things the students have done have been effective in terms of habitat for wildlife. We had had mallard ducks come in and nest," said Spigner. "We think our fish population has increased. Our data is supporting that conclusion."

STILL HAVING FUN

Like many educators, Margaret Spigner did not go straight into teaching after graduating from college. Her undergraduate degree from Radford University in Virginia was in interior merchandising, with a minor in art. Once out of school, she got a job designing and selling kitchen renovations. Then one day she went to a local high school that needed a redo for its home economics kitchen. The teacher she worked with on the job convinced her she'd be a great teacher herself.

She started the process of obtaining state certification. She thought she'd be able to teach home economics and design, but it turned out she couldn't, because she didn't have the proper educational credentials. She'd taken a number of science courses in

college, however, particularly chemistry, which is applicable to art. The state of South Carolina needed science teachers.

"They said, 'We'll certify you in either biology or chemistry,'" Spigner recalled.

In 1982 she started as a novice teacher at Trident Academy in Charleston. Five years later she switched over to Middleton High School in West Ashley, one of six major areas within Charleston city limits. She's been there since. (In 2000, Middleton combined with another public secondary school to form West Ashley High.)

"They didn't have marine science as a course at Middleton when I first started teaching. We introduced it," she said. "It was just a perfect fit in Charleston, partly because we're so close to the ocean."

Along the way she's picked up a master's degree in teaching secondary education, with an emphasis on biology and marine science, from The Citadel. She's accumulated more than 85 hours of postgraduate schooling at area universities in STEM leadership education.

Technically, she is retired. But the state still needs science teachers, so she is in a "carry program" where she is offered retirement but is able to bank that offer and continue working for five years.

"As long as I'm still having fun, I think I'll stay," she said.

Spigner says that one of the best parts of teaching is seeing kids create and design. It's extra special if she sees that experience help them be successful later on.

Recently she shepherded a team through a regional round of the SeaPerch Challenge, a competition for small underwater ROVs. For SeaPerch, students build me-



Rear Adm. Brian Brown (l) and team mentor Walter Runck (from SPAWAR, the Navy's Information Dominance systems command) pose with Spigner's SeaPerch team. The students are (l-r) Chandler Burt, Matthew Heidtman, and Emilie Lombardi.



Spigner accepts her Air Force Association Teacher of the Year award from AFA Board Chairman George Muellner (l), Vice Chairman for Aerospace Education Jerry White (c), and Vice Chairman for Field Operations Scott Van Cleef (r) at AFA's National Convention in September 2013.

chanical "fish" from similar kits, perfect them, and then battle head-to-head in a series of events, such as obstacle course navigation or the retrieval of weighted objects.

One of the 25 judges at this event attended Spigner's classes as a youngster. After high school, this woman eventually earned a doctorate in marine science and went to work for the National Oceanic and Atmospheric Administration. She'd designed a method of measuring water quality with small clams.

"That was my student," Spigner said proudly.

Her current students did very well in the competition. West Ashley kids took first, second, third, and overall, among 52 schools. (The fact that one of the judges was an alumna had no influence on the outcome, Spigner hastened to add.)

SeaPerch is popular with her classes, Spigner said. It's another example of her belief in project-based learning. Students assemble the ROV kits themselves, learning wiring and soldering. Then they go through an engineering process to try and determine which shapes are the most hydrodynamic.

They learn a number of physics concepts while they're enjoying building their remotely controlled mini-subs. Then they get to put them through their paces in a contest against other teams.

When the contest is over, students can adapt SeaPerch ROVs for real-world uses. The ROVs that Spigner's kids are using in their detention pond are former SeaPerch kits.

"We're always trying to develop new ways to play with our toys," she noted.

When the Deepwater Horizon oil spill in the Gulf of Mexico was in the news in 2010, it prompted lots of discussion in Spigner's classes about ROVs and their

use in underwater environmental disasters. In 2014, with the mysterious disappearance of Malaysian Airlines Flight 370, the class has once again had an opportunity to talk about the possible uses of underwater ROVs in real-world searches.

"It is STEM, SeaPerch," observed Spigner. "We've been doing that since I started in teaching 30 years ago. We just never named it STEM."

GOOGLE IT

Spigner added that within STEM education the teaching of teamwork is almost as important as the teaching of scientific skills. There aren't too many science or engineering jobs where people work as individuals. Most involve teams. Indeed, most jobs of all sorts require teamwork.

Before the WATER Wildcats start on a major project they will spend four to five days on team-building exercises. They do "crazy things," said Spigner, such as seeing which teams can build the tallest structure out of a box of forks.

"We build a comfortable relationship in the team before we begin a challenge," noted Spigner. "If you do that as a teacher—get them to feel safe and comfortable in a team—it is amazing what you can bring out in individual students."

In Spigner's classes, students take on roles within projects that imitate roles they might gravitate toward in a professional career. There are student project leaders, communications liaisons, design and engineering managers, support staff, and so forth.

There is even a student grant-writing team. It has won donations totaling more than \$10,000 for the school from a wide va-

riety of organizations. The WATER Wildcats have been named Overall Champions of the Environment by South Carolina's Department of Health and Environment Control. They've been featured in a TV commercial promoting the state.

Spigner herself has picked up grants from NOAA, Walmart, and Boeing, among others. She and her students go to elementary and middle schools in the area to show off their work and talk about the environment and the pollution around them.

Due to her work, "thousands of students have benefited and come to have a better understanding of the world they live in," wrote Charleston Mayor Joseph P. Riley Jr. in a letter supporting Spigner's award candidacy.

One thing that's changed a lot over the decades of Spigner's career is technology. Every kid now seems an expert in tablet and smartphone applications and technology. The answer to every question seems to be "Google it."

"The technology piece has just exploded. ... It's been a learning curve for me for some time," said Spigner.

She's had to take an iPad class herself. She learned how to design apps in a technology class at The Citadel.

School microscopes used to be simple optical devices; now they're computer-aided optics equipped with USB connectors. "Funding is always an issue," she said. "Our district is really working hard to keep up with technology."

One new educational endeavor looming in her future is CyberPatriot. Spigner has signed on as a coach of an open division team in the Air Force Association-sponsored student cyber defense competition. West Ashley High School has a JROTC CyberPatriot squad as well.

"You are to be commended for the above-and-beyond commitment you give so unselfishly in order to help prepare the next generation's national STEM workforce," wrote AFA Vice Chairman for Aerospace Education Jerry E. White in a letter informing Spigner of her Teacher of the Year honor. ■

Peter Grier, a Washington, D.C., editor for the Christian Science Monitor, is a long-time contributor to Air Force Magazine. His most recent article, "Mission Accomplished," appeared in February.



Announcement

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AFA National Report

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By Frances McKenney, Assistant Managing Editor

Photo by JoseAndresRuizPhotography.com



Former Secretary of State Madeleine Albright—wearing one of her famous brooches—meets Maggie Woodward (left) and Dan Woodward (center) before delivering a keynote address, a highlight of the Arnold Air Society-Silver Wings Conclave.

Photo by JoseAndresRuizPhotography.com



Albright chats with Scott Van Cleef (right), AFA's Vice Chairman of the Board for Field Operations, and Leonard Vernaonti (center), AFA's National Treasurer.

Photo by JoseAndresRuizPhotography.com

Conclave in D.C.

When some 1,150 Arnold Air Society AFROTC cadets and students from Silver Wings gathered in Washington, D.C., in April for their National Conclave, they had backing from several local Air Force Association chapters: the **Nation's Capital Chapter** in D.C.; the **Donald W. Steele Sr. Memorial Chapter** and **Gen. Charles A. Gabriel Chapter**, both in Virginia; and the **Thomas W. Anthony Chapter** of Maryland.

An affiliate of AFA, the Arnold Air Society is a professional, honorary service organization for cadets in Air Force officer candidate programs. Silver Wings is its sister organization, with a membership of college students focused on community service and supporting the military.

AFA's involvement in the 2014 AAS-SW conclave began last year when Nation's Capital Chapter member Lt. Col. Darryl Terrell, from Howard University's AFROTC Det. 130, told the chapter that the cadets wanted D.C. to be the next convention site. The chapter and its industry partners backed the cadets' campaign, arranging for the designing and printing of the brochure and nomination material used at the 2013 NATCON in Atlanta to bid for Washington as the 2014 host city.

When D.C. won the honor, the hard work began, said Nation's Capital Chapter President Bruce VanSkiver. "It was like the dog chased the car and caught it. Now what?"

VanSkiver, an AAS alumni, headed a steering committee for the local AFA chapters. They concentrated their efforts on organizing a Saturday night social, where the college students would have a chance to speak informally with senior leaders from the Air Force, government, and industry.

The Anthony Chapter president, John L. Huggins Jr., said most of his group's fund-raising came through member

In her keynote address, Albright spoke of how the Air Force touched her life, going back to her childhood and the AAF in World War II London. Here, she takes part in the Q&A moderated by Silver Wings President Ryan Westfall.



Photo by Jonathan Dagle

AAS cadets and Silver Wings students listen to the US Air Force Band's Max Impact rock group at the Saturday night mixer funded by four Washington, D.C.-area chapters.



donations. He called this "only natural" because they have long supported their area's cadets in wide-ranging projects.

As for the other chapters' fund-raising, VanSkiver said, "We scoured all the industry partners out there." With their help, the four chapters raised more than \$25,000.

That secured the Smithsonian's National Air and Space Museum as the location for the after-hours, private-function Saturday night social. VanSkiver gave credit to chapter member Jack Catton Jr. and Steele Chapter's Duncan J. McNabb, who both worked to lower the price of this venue, chosen for its aerospace education value.

Some of the other high-profile events during the five-day conclave were keynote addresses by former Secretary of State Madeleine K. Albright, USAF Chief of Staff Gen. Mark A. Welsh III, and Lt. Gen. David Goldfein, director of the Joint Staff. AFA also sponsored an awards luncheon, with its Vice Chairman of the Board for Aerospace Education, Jerry E. White, as master of ceremonies.

AAS Executive Director Daniel P. Woodward said this gathering was the second most widely attended National Conclave in a decade and couldn't have been carried out without help from the AFA chapters.

New AFA Chapter: Pride of the Adirondacks

Besides Washington, D.C.'s, selection as the 2014 conclave site, something else resulted from last year's AAS-SW National Conclave: one of AFA's newest chapters, **Pride of the Adirondacks**.

Centered at Clarkson University's AFROTC Det. 536 in Potsdam, N.Y., the chapter first met on March 2, 2014.

That was 17 days before Scott Van Cleef, AFA's Vice Chairman of the Board for Field Operations, even signed its charter. Chapter President Nicholas Donato formally received

Northeast Region President Maxine Rauch (far left) presented AFA's new chapter, Pride of the Adirondacks, with its charter on April 12. Donato holds the document.



Photo by JoseAndresRuizPhotography.com

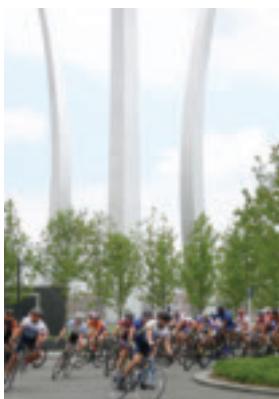
Pride of the Adirondacks Chapter President Nicholas Donato (second from right) and several fellow cadets drove from upstate New York to D.C. to attend the 2014 AAS-SW National Conclave. Above: They relax between business sessions.



Photo via Maxine Rauch

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This yearbook photo features AFROTC cadet Robert Barns (left) helping sophomore Cynthia Rubio, member of an upstate New York high school Cyber-Patriot team. The Genesee Valley Chapter got this team established.



Photo by MSGt. Greg Cross

the document on April 12, when Northeast Region President Maxine Rauch and Charles Rauch, the New York state president, traveled up from Long Island, N.Y., to the Clarkson campus.

A sophomore majoring in aeronautical engineering, Donato says he was inspired to start the chapter last year, after attending the conclave, where he was encouraged to make contact with his local AFA chapter as a way to strengthen AAS. Back on campus, though, he searched the AFA website and couldn't find one. So he decided to take the initiative.

Donato says that being a member of an AFA chapter differs from belonging to AAS because the chapter is "not limited to cadets" but has a broader scope, including veterans, local business leaders, and others who support a strong national defense. He has been "working on generating interest in the community" from other military-related organizations and has received good feedback from Clarkson faculty members.

Besides Donato, the new chapter's officers are: Jessica V. Szeliga, VP; Joseph A. Scataro, secretary; and Nathaniel G. Warren, treasurer.

The chapter takes its name from a B-47 that served in Strategic Air Command. *Pride of the Adirondacks* won so many "Best" awards at a 1965 SAC bombing and navigation competition at Fairchild AFB, Wash., that some called it the "World's Best B-47." It was put on static display at Plattsburgh Air Force Base—today an airport—when SAC began phasing out Stratojets. The bomber is still there, and now, so is a new AFA chapter.

CyberPatriot

The yearbook for the Franklin School of Integrated Arts and Technology just came out. It features three photos of the Rochester, N.Y., school's CyberPatriot VI team—a group born over a cup of coffee from the **Genesee Valley Chapter**.

Team coach Joseph T. Cicero, a social studies teacher at the school, explained that Chapter President Alfred E. Smith took him and biology teacher Timothy Johnsen out for coffee one day. Smith wanted them to participate in CyberPatriot, AFA's cyber education and competition program. But the teachers were worried about the time commitment involved, wondered if they could find enough students to form a team, and weren't sure they had enough technical expertise.

The solution? Smith "pulled in RIT," says Cicero. That's the Rochester Institute of Technology, where chapter member Lt. Col. Erik J. Lagerquist heads AFROTC Det. 538.

Backed by those resources, Cicero said he and Johnsen then "felt like we weren't going it alone."

To their surprise, 20 students applied for a place on the team. Cicero said this enabled him to be selective. He said he pulled the "smartest of the smart" from his Advanced Placement World History class, for example.

School officials understood that training for the competition meant the team members learned and applied science, technology, engineering, and mathematics in a hands-on way. They sometimes excused the team members from classes, says Cicero. So on occasion, the CyberPatriot students could spend the entire day training.

The team was a "middle scorer" in the competition, Cicero says. "No trophies or medals." But yearbook honors. And the team told him they will all be back for the next round of CyberPatriot.

Party Crashers

A hundred people crashing an AFA awards banquet?

It happened to California's **Robert H. Goddard Chapter** as cohosts of the

44th annual joint awards presentation with a local Air Force Sergeants Association chapter.

The afternoon reception in March took place at Vandenberg Air Force Base's Pacific Coast Club and honored the top performers from the 30th Space Wing. Among the winners were: chapter member Lt. Col. Ramiro Riojas, from Vandenberg's National Reconnaissance Office, named Military Member of the Year; Lockheed Martin, named Community Partner of the Year; and the 2nd Range Operations Squadron, Falcon 9 Crew, recognized as Best Space Operations Crew.

Chapter President Juan E. Cruz said the planners think in terms of squadrons and knew some were bringing 20 guests, some only three or four, and one squadron never replied to the invitation.

"We made allocations just in case," Cruz commented. Good thing because the enthusiasm of unit commanders, the lure of food, and the event's time slot—people didn't have to return to work afterward—brought out extra guests, he said.

"We did have a bit of chaos for about five minutes," wrote Cruz in an email, "but the young airman who was in charge of seating, A1C Stephen Spor, was able to think on his feet and was able to accommodate all of our guests."

Retired CMSgt. James E. Lokovic, vice chairman for the AFSA International Legislative Committee and a member of AFA's **Salt Lake City Chapter**, was guest speaker.

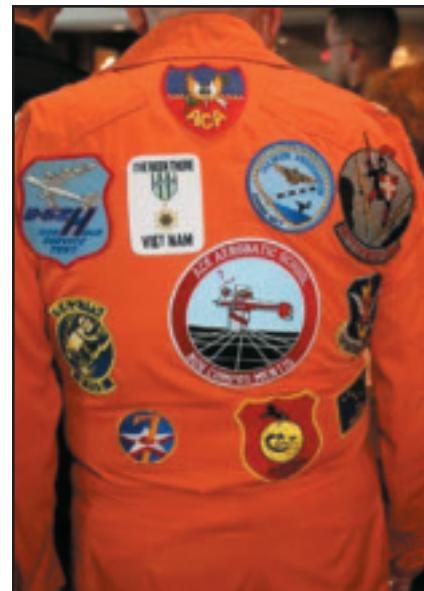
See photos from the awards presentations on the chapter's Facebook page.

Drumbeats & Hangar Stories

Dann D. Mattiza, Florida Region president and **Hurlburt Chapter** membership director, credits a retired vice admiral with the idea.



At the joint-services all-aviators gathering—co-hosted in Florida by the Hurlburt Chapter—many guests displayed their military résumé on their backs.



Jerry Unruh realized that since military support organizations all have chapters in the Pensacola area, why not bring them together, so members can meet each other, plan community projects, and—of course—tell “hangar stories”?

Unruh pulled in representatives from AFA, Navy League, Marine Corps League, and Order of Daedalians military pilots. He then looked beyond this circle and invited USAF’s 479th Flying Training Group, headed by Col. Thomas B. Shank, from Naval Air Station Pensacola and all fliers, Active Duty, retired, and former-service, from all branches.

A steering committee held weekly “drumbeat” meetings—status updates—

by telephone. Mattiza emails: “The reports from committee members sounded positive and encouraging, but we really could only guess at the final attendance numbers.”

In the end, some 300 guests showed up at the Pensacola Yacht Club for the event. Mattiza said: “Aviators in flight suits (even the older guys) came through the doors, along with a number of special invitees who flew in World War II, Korea, and Vietnam.”

One of them was retired USAF Lt. Col. Thomas S. Pyle, a Hurlburt Chapter member with hangar stories from two services and a reserve component. Pyle served in the Marine Corps from 1954

to 1957, in the Marine Corps Reserve until 1959, then in USAF as an F-105 electronic warfare officer at Takhli RTAB, Thailand. He was shot down near Hanoi in 1966 and remained a POW until 1973.

The all-aviators joint-services event proved so successful that Mattiza said, “We will be hosting our next event in a few months.”

More Chapter News

■ On April 2, the **Swamp Fox Chapter** in Sumter, S.C., co-hosted their

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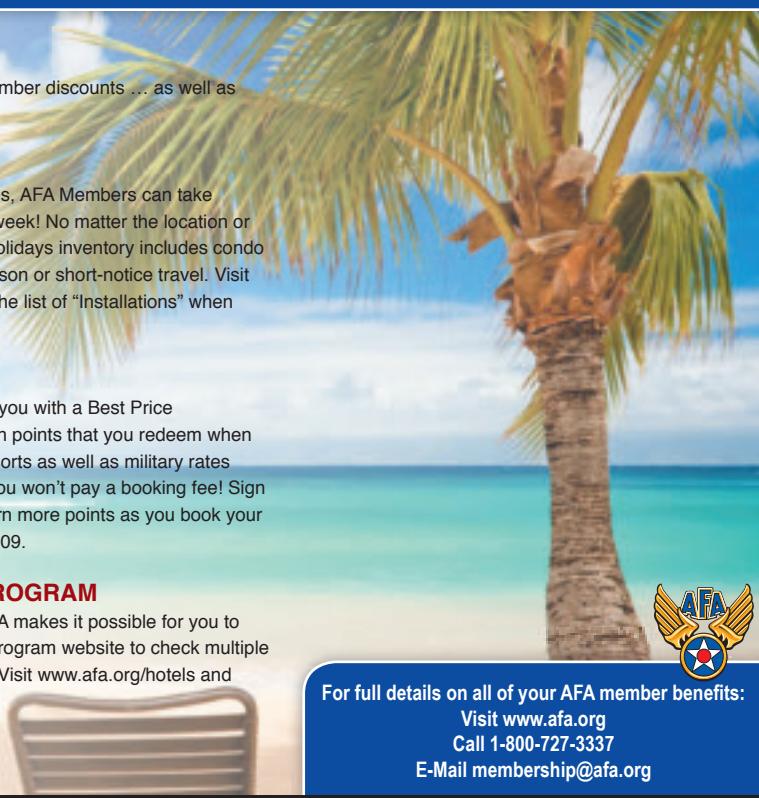
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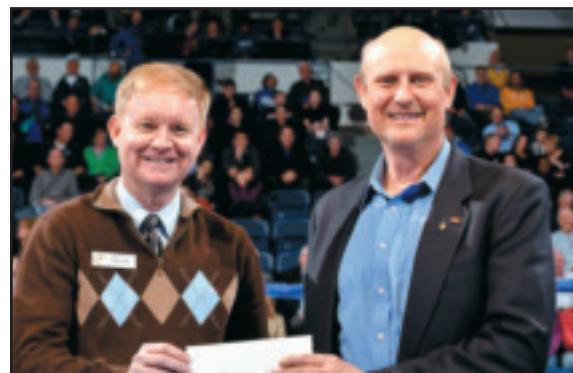
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In South Carolina, Swamp Fox Chapter President Bush Hanson (left) welcomed guest speaker Maj. Gen. Jim Post, who spoke about sequestration's effects on Air Combat Command's readiness.

yearly dinner with the Greater Sumter Chamber of Commerce. Maj. Gen. James N. Post III was guest speaker. He is director of operations at Air Combat Command at JB Langley-Eustis, Va., and served nearly three years at Shaw AFB, S.C., as an F-16 evaluation pilot, an operations officer for the 79th Fighter Squadron, and most recently as commander of the 55th Fighter Squadron. Chapter President Bush Hanson said 140 guests turned out—a solid number, considering the event had been delayed for more than a month, due to a severe ice storm in mid-February. ■

Jerry Allen DeBusk holds a book and an AFA Certificate and wears a chapter-produced medallion—all presented by Florida's Sarasota-Manatee Chapter President Mike Richardson (left). DeBusk and Kaia Clark received awards from the chapter for their aerospace-themed entries in the Sarasota Regional Science, Engineering, and Technology Fair.



And in this corner: At the Air Force Academy's boxing tournament, Scott Hallam (left) receives a donation from Tom Ocvirk, secretary of the Lance P. Sijan Chapter in Colorado. Hallam represented The Home Front Cares charity. The chapter raised funds for it through a pizza party attended by 80 guests before the boxing match.



Leigh Wade Chapter President Gary Metzinger (back row, center, in sunglasses) and chapter member CMSgt. Jeffrey Gideon (back row, second from left) ran a 5K in April with 345th Training Squadron members from Fort Lee, Va. The road race helped fund the Virginia War Memorial in Richmond, Va.



Lauren Incontrera received the national-level AFA 2013 VA Employee of the Year award, presented by the Gen. Carl A. "Tooey" Spaatz Chapter in New York in April. Incontrera is the women-veterans program manager for the VA's Hudson Valley Health Care System. Chapter officers are l-r: Howard Harmon, William Shemedra, William Sarama, Edward Garrett, David Ribbe, Joseph Traina, and Gilbert Raines.



Civil Air Patrol Raritan Valley (N.J.) Composite Squadron cadets used an AFA/CAP grant to help them compete in a robotics tech challenge. That's their robot in front of them.

reunions@afa.org

Reunions

1st Flight Det, Nha Trang AB, South Vietnam (1964-72). Oct. 19-24, Las Vegas. **Contact:** Roger Gibson (228-209-1181) (rgibson2403@aol.com).

20th & 81st TAC Fighter Wg Gp. Oct. 8-14, The Villages, FL. **Contact:** Gregory Vogel (352-633-6029) (gvogel55@yahoo.com).

410th Security Police Sq. July 12, former K.I. Sawyer AFB, MI. **Contact:** Kurt Carlson (carlson.kurt@yahoo.com).

Berlin Airlift Vets Assn. Sept. 30-Oct. 3, Nashville, TN. **Contact:** J. W. Studak, 3204 Benbrook Dr., Austin, TX 78757 (512-452-0903).

Phan Rang AB, South Vietnam. Oct. 9-11, Doubletree, Tucson, AZ. **Contact:** Lou Ruggiero (louruggs@comcast.net).

UPT Class 67-D. **Contact:** Mike Ridnouer (704-385-9613) (dridnouer@mindspring.com). ■

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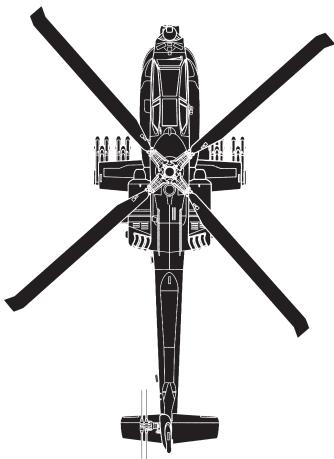
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Airpower Classics

Artwork by Zaur Eylanbekov

AH-64 Apache



The US Army's AH-64 Apache attack helicopter has dominated land combat for decades with its speed, electronics, and deadly firepower. This powerful combination enabled eight Apaches on the first day of the Gulf War to destroy two key Iraqi radar sites and help clear the way to Baghdad for Air Force F-117 stealth aircraft. The Apache has distinguished itself in Afghanistan, Panama, and Israeli-Arab conflicts.

The Apache is a twin-engine aircraft with four-blade main and tail rotors and a tandem cockpit for pilot (rear) and copilot gunner (forward). Intended to replace the Bell AH-1 Cobra, it began life as the Hughes YAH-64. McDonnell Douglas purchased Hughes Helicopters in 1984 and then merged with Boeing in 1997. Production and

development continued with the vastly improved AH-64D Apache Longbow. Maintenance and other difficulties impeded its effectiveness in Bosnia and Kosovo, however.

Both crew members can fly the aircraft and use ordnance. Day and night attack capability is enhanced by the night vision systems and a sophisticated nose-mounted sensor suite for target acquisition. The stub wings have four hardpoints for armament. The powerful 30 mm M230 chain gun cannon is mounted in a rotating turret under the forward fuselage, between the tailwheel-type undercarriage. Many redundant systems and strengthened structural components were designed to enhance crew survivability.

—Walter J. Boyne

This aircraft: US Army AH-64D preproduction Apache Longbow—#90-0423—as it looked in 1994 when assigned to Army Materiel Command, Fort Hood, Texas.



A US Army AH-64 Apache helicopter takes off during combat search and rescue training in Germany.

DOD photo by A1C Dillon Davis

In Brief

Designed, built by Boeing (formerly Hughes, McDonnell Douglas) ★ first flight Sept. 30, 1975 ★ crew of two (pilot, copilot/gunner) ★ two GE T700-GE-701 turboshaft engines ★ number built about 1,800 ★ **Specific to AH-64D Longbow:** max speed 182 mph ★ cruise speed 165 mph ★ max range 275 mi ★ armament one 30 mm chain gun, AIM-92 Stinger missile pack, four AGM-114 Hellfire missiles and/or Hydra 70 rockets ★ weight (max) 23,000 lb ★ span (rotor diameter) 48 ft ★ length 58 ft 2 in ★ height 12 ft 8 in.

Famous Fliers

Notables: Richard Cody, Rucie Moore, Tory Myers, Charles Roman, Cynthia Rosel, Alex Swyrynn, David Williams, Ronald Young Jr. **Test Pilots:** Raleigh Fletcher, Mark Metzger, Robert Ferry.

Interesting Facts

Employed in combat first by Netherlands ★ produces less noise with four-bladed rotor than do most other aircraft with two-bladed rotors ★ achieves air-to-air capability through employment of AIM-92 Sidewinders ★ can be used to designate targets for fighter aircraft ★ older models remanufactured in early 2000s into far deadlier Longbow variant ★ destroyed 278 Iraqi tanks and numerous other Iraqi vehicles in Gulf War, with only one loss ★ can be transported in either C-5 or C-17 airlifters ★ produced under license in Britain and in Japan ★ flown by Egypt, Greece, Japan, Israel, Netherlands, Taiwan, Saudi Arabia, Singapore, US, and Britain.



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